EXECUTIVE MODEL 50
Operation and Maintenance Manual

INTERNATIONAL
CRYSTAL MFG. CO. INC.

EXECUTIVE MODEL 50
Operation and Maintenance Manual

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INTERNATIONAL
Crystal Mfg. Co., Inc.
18 N. Lee
Oklahoma City, Oklahoma

VOLUME
SQUELCH
INTERNATIONAL
CRYSTAL
MFG.
TUNE
RECEIVE
SELECTOR
CHANNEL
TRANSMIT
SELECTOR
TRANSMIT
RECEIVE
Executive

ADDENDUM TO MODEL 50 3/21/62

Effective on units with (SD) serial numbers and later.

Change the following component on power supply schematic.

Change R46 from 39 ohm 2W 10%
to 56 ohm 2W 10%

Manual 170-173
Issued 3/22/62

ADDENDUM MODEL 50 OPERATION AND MAINTENANCE MANUAL

The following changes have been made in all executive Model 50 tranceivers with serial number SD and later.

The following changes should be made in this manual.

1. Under section II, Transmit-Receive Relay Circuit Description change 6 volt secondary to 12 volt secondary.

2. Under section IV, Power Plugs
Add: 115 VAC plug, part No. 150-174, price each $7.50.
NOTE: 115 VAC plug, part No. 150-120 is used on units made prior to April 1, 1962, or units with serial numbers before SD.

3. Under Power Plug Wiring, Model 50 diagram is used only for units produced prior to April 1, 1962. The Model 100 diagram is used on all units produced after this date.

4. Under Section V, Voltage and Resistance Charts, the following column changes should be made.

Power Pin No.	Receive	Transmit
4	13 VAC	13 VAC
20	Not Used	----
21	13 VAC	13 VAC
24	Not Used	----
36	13 VAC	13 VAC

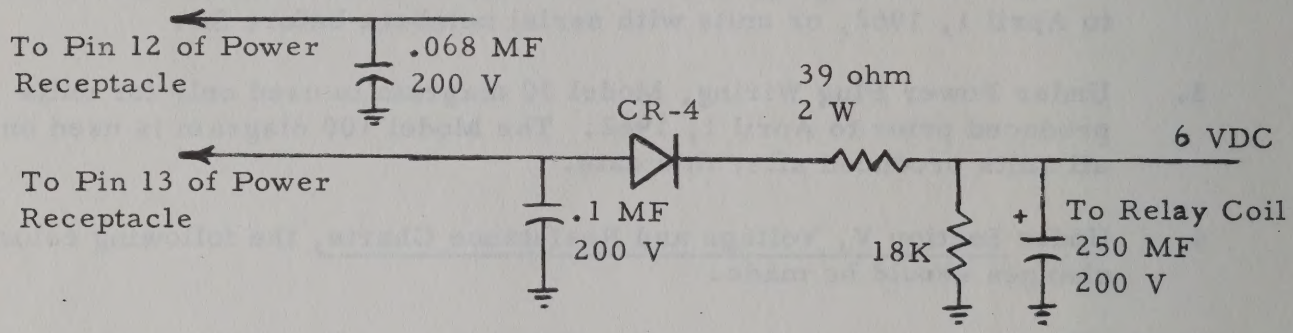
5. Under Section V, Vacuum Tube Voltage and Resistance Chart, the following changes should be made.

Tube No.	See Note	1	2	3	4	5	6	7	8	9
V2	R					13VAC				
	T					13VAC				
V4	R				13VAC					
	T				13VAC					

	R	13VAC
V5	T	13VAC
	R	
V7	T	
	R	
V8	T	

6. On Transmitter Model 50 circuit, Add a neon bulb (NE-1) across the coil of relay TR-1.

7. On Power Supply Model 50 circuit, change circuit as shown below.



8. Power supply connections on Power Supply Circuit; change 115 VAC legend to read as follows.

115 VAC	115 VAC to pins 1 and 4 Jumper Pins 2-3, 13-18

9. On Power Supply Model 50; Top View, Power Supply and Transmitter; Bottom View, Power Supply and Transmitter note that the following parts have been used in modification.

T4, Power transformer changed from 6 volt to 12 volt secondary.

39 ohm, 2W resistor added to relay power supply.

.1 mf 200 V capacitor added to relay power supply.

.068 mf 200 V capacitor added to pin 12 of power receptacle.

Remove 470 ohm, 1/2 Watt resistor from relay power supply.

18K, 1/2 Watt resistor added to relay power supply.

Vibrator socket shield added to vibrator socket.

Neon bulb added across relay coil.

10. The above changes should also be made on the fold out circuit of the Model 50 in the back of your maintenance manual.

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Bottom View of Power Supply

Schematic of Complete Unit

SECTION I

GENERAL

The INTERNATIONAL EXECUTIVE, Model 50, is a Citizens Band unit which combines a sensitive and selective, dual conversion superheterodyne receiver, with a highly stable and efficient, crystal controlled transmitter. The complete transmitter, receiver and power supply are housed in an attractive, brown and brass colored cabinet, to blend favorably in the home, office, car or truck.

The receiver manually tunes all 23 Class "D" Citizens Band channels. In addition, two receiving crystal sockets are provided in the unit, for the selection of any two desired channels. The selection of either crystal controlled channel, or manual tuning, is accomplished with a three-position switch on the front panel. A squelch circuit is built-in, to provide receiver quieting during periods when no signal is being received.

The transmitter oscillator uses fundamental crystals, operating at one-half the desired operating frequency. The crystal supplied has a frequency tolerance of ±.005% when used in the EXECUTIVE.

The EXECUTIVE has been designed with flexibility of installation in mind. It may be used in the home or office, with power secured from the AC line. It may also be used in a car, boat, plane or other mobile and portable applications, wherever there is 6 or 12 DC available. It may be used with a base loaded whip antenna, regular whip, long wire, ground plane, beam and other types of antennas. The attractive case design lends itself to use in the home or office without appearing unsightly or out of place.

Though the unit is very versatile, it is not to be expected that either receiving or transmitting results will be the same in every installation. As in all radio communications and particularly in VHF applications, the type of antenna, its location above ground, the noise present in the area and other factors are bound to affect the results obtained.

SPECIFICATIONS

Receiver:

Tuning Range (Manual tuning)	26.955 to 27.265 mc, (Class "D" Citizens Band, Channels 1 through 23).
Tuning Range (Selector Pos. 2)	Crystal Controlled - Any Channel, 1 through 23.
Tuning Range (Selector Pos. 3)	Crystal Controlled - Any Channel, 1 through 23.

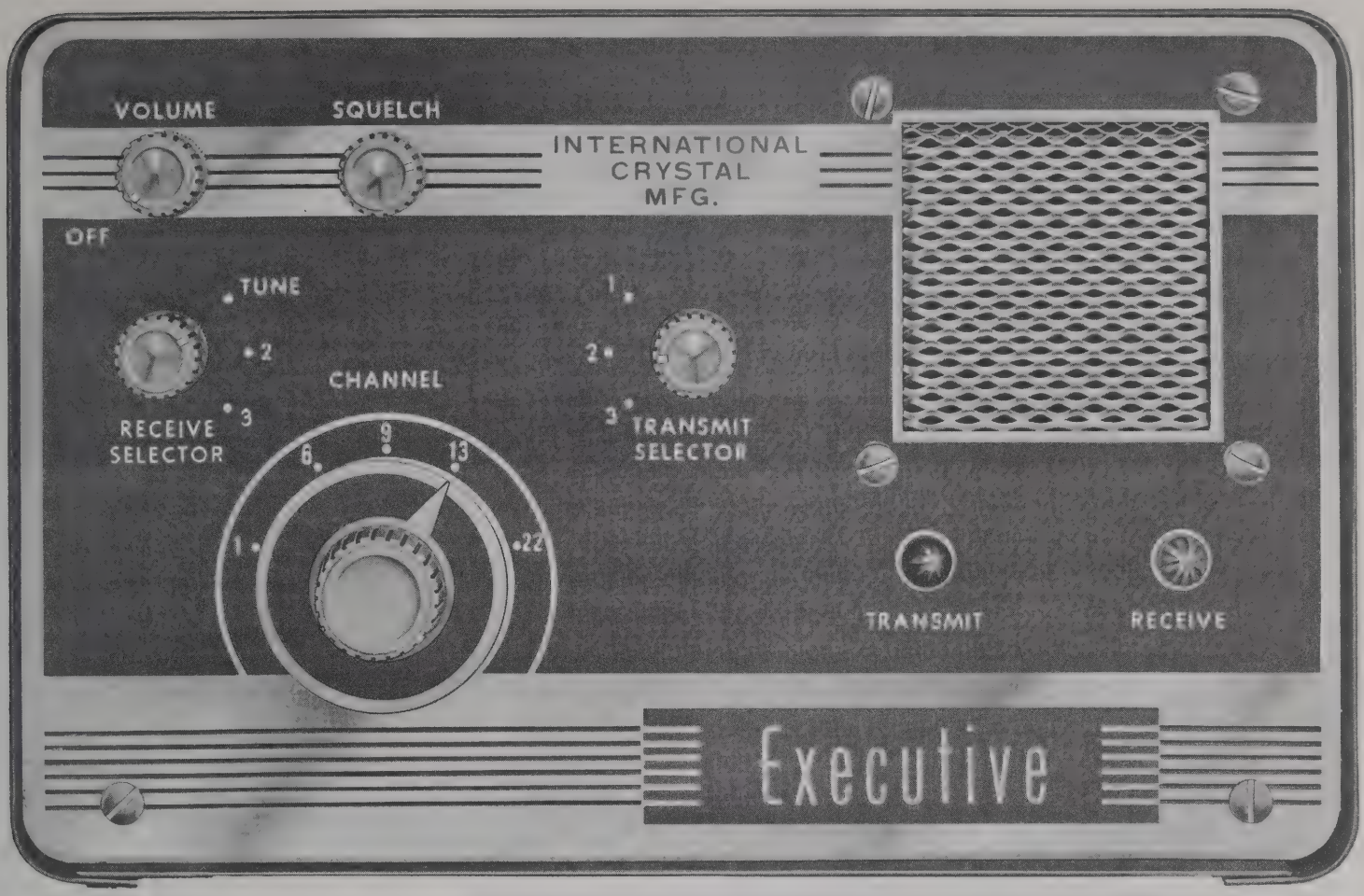
Sensitivity	Usable to .5 microvolt
Selectivity	15 db down at 10 kc 60 db down at 30 kc
Image Rejection	Better than 50 db down
Audio Output	2.5 watts into 4-6 ohms
Speaker Impedance	4-6 ohms
Squelch range	5 to 50,000 microvolts. On-off differential is approximately 1 microvolt at 5 microvolt input.
Noise Limiter	Automatic, series-gate

TRANSMITTER

Frequency Stability	±.005% @ 0° to 125°F, when used with INTERNATIONAL high stability fundamental crystals.
RF Power Input	5 watts maximum (FCC rules)
Modulation	Capability - 100%
Crystals Required	INTERNATIONAL, high stability, fundamental type, at one-half the desired frequency.
Microphone	High impedance crystal, ceramic or high output dynamic type. (Push-to-talk switch required.)

POWER CONSUMPTION

Transmitting	65 watts (approximate)
Receiving	60 watts (approximate)
Weight	12 pounds (approximate)



FRONT PANEL CONTROLS

VOLUME

On-off switch, volume control. To turn receiver on, turn the knob clockwise. Clockwise rotation of the knob also increases the volume level.
Allow the set to warm up for about one minute before you wish to use it.

SQUELCH

This control is used to eliminate background noise when no signal is being received. Upon initial warmup, turn this control fully counter clockwise until a click is heard. The switch in the squelch control is **off** in this position. To operate, turn squelch control on and fully clockwise. Then slowly turn the control counterclockwise until the background noise just disappears. Leave the control set at this point. Do not turn the control too far counterclockwise as this will reduce the receiver performance and weak signals will not be heard.

RECEIVE SELECTOR

Set this control to TUNE unless receiver crystals have been installed in positions #2 and #3, in which case set the switch to the desired crystal position for crystal controlled reception.

TRANSMIT SELECTOR

A channel 9 crystal has been installed at the factory in switch position #2. Place the switch in this position unless you have had other crystals installed, in which case select the channel on which you desire to transmit.

CHANNEL (Tuning)

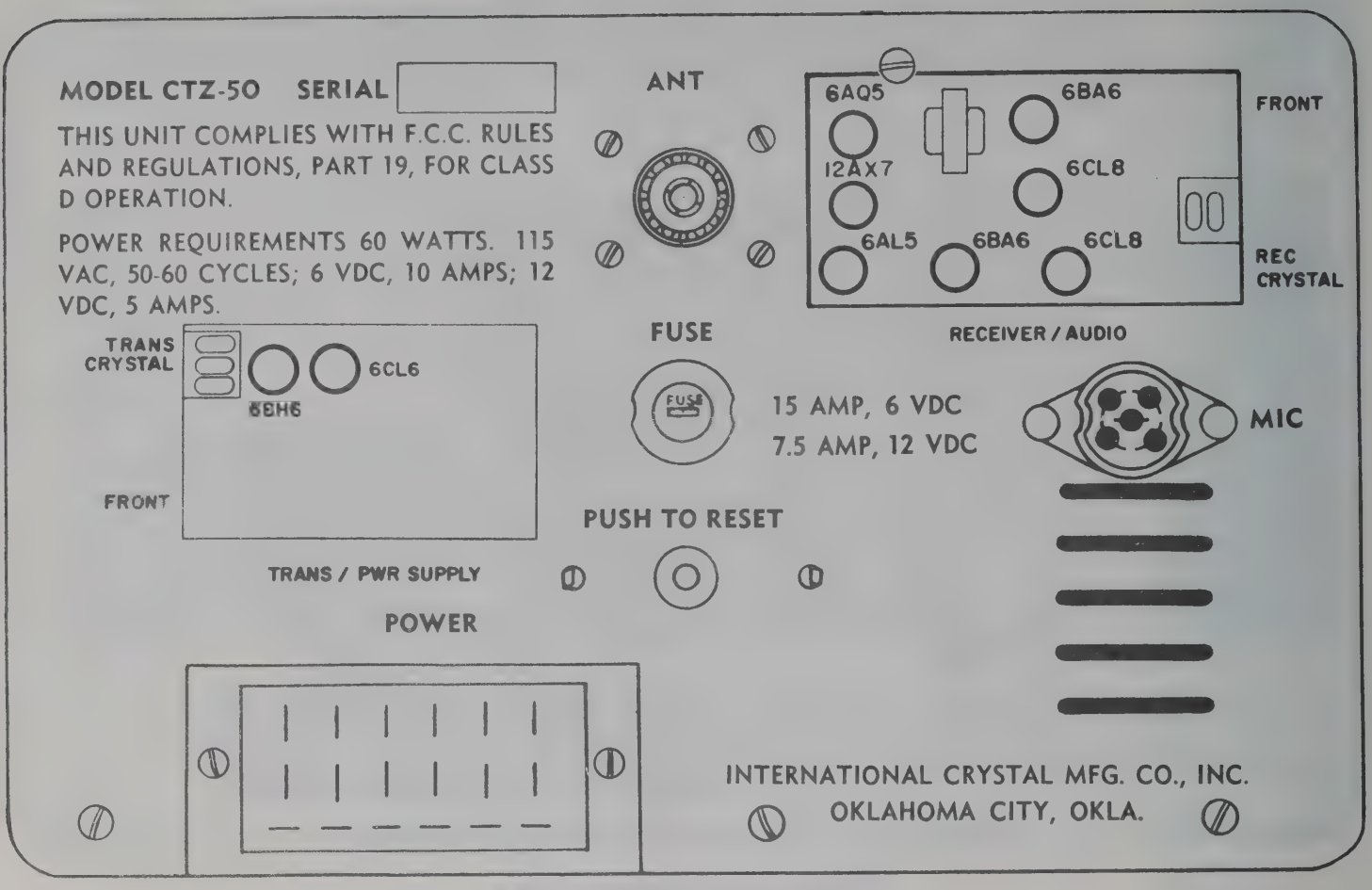
With the RECEIVE SELECTOR set in TUNE position this control tunes the receiver through the range of all 23 channels. The approximate locations of channels 1, 6, 9, 13 and 22 are indicated on the panel. Other channels fall in between these points.

TRANSMIT (Indicator)

This indicator functions as an audio level monitor. Depress the microphone keying button and speak directly into microphone. The indicator light will flicker intermittently as you speak in a normal voice level. With indicator operating on voice peaks, modulation will be about 95%. When talking too close to microphone the indicator lamp will glow almost constantly. This can result in over-modulation and cause adjacent channel interference. This indicator will flicker when the transceiver is in RECEIVE position also, showing proper operation of the receiver audio section.

RECEIVE (Indicator)

This functions as an on-off (plate voltage) indicator for the receiver section of the transceiver. When in RECEIVE position the lamp will glow steadily and go out when the transceiver is placed in TRANSMIT position.



REAR PANEL CONTROLS

ANT (Antenna Receptacle)

This receptacle is used to connect the transceiver line to the transmit-receive relay, TR-1. The receptacle is a standard low-loss, VHF type designed for 50- to 72-ohm coaxial cable.

MIC (Microphone Connector)

This connector requires a five-prong plug which is furnished with the unit. High impedance crystal or ceramic type microphone may be used with this transceiver. Proper plug wiring for either crystal or ceramic microphones is shown on the next page.

FUSE

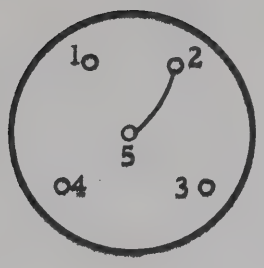
A 15 ampere fuse is installed in the fuseholder and may be changed or replaced, if necessary, by unscrewing the red insert in the center of the holder. If the transceiver is to be operated on 12 volts dc the fuse should be replaced with one having a rating of 7.5 amperes.

PUSH TO RESET

This is a thermal cut-out. It protects the unit when it is being operated on 115 volts ac. If overload causes it to cut out, it can be reset by pressing in on the plunger and holding it in for about two seconds.

POWER

An 18-contact plug is used as a power connector. This allows various input voltages to be used without requiring changes within the unit. All necessary connection changes are made on the external plug. Three different power cord assemblies are used, one for each input voltage.



MICROPHONE PLUG WIRING

Hi-impedance microphone

Pin 1 - Hot lead of mike
Pin 2 - Shield of mike cable
Pin 3 - No connection
Pin 4 - Mike switch
Pin 5 - Ground
A jumper is placed from pin 2 to pin 5

Note: When pin 4 of the plug is grounded, as it is when the mike switch is closed, the relay in the EXECUTIVE is energized, operating the transmitter section of the unit.

SECTION II

RECEIVER CIRCUIT DESCRIPTION

The receiver section of this transceiver is a double conversion unit employing the superheterodyne principle of frequency conversion. The first converter is composed of three basic sections; an rf amplifier, mixer, and oscillator which is either tunable or crystal controlled.

A received signal from the antenna is coupled to the control grid of the rf amplifier through a double tuned circuit consisting of coils L1 and L2, their respective shunting capacitors, and coupling capacitor C3. This double tuned circuit aids greatly in the elimination of unwanted signals outside the passband to which it has been tuned. The gain of the rf amplifier is controlled automatically by the receiver's AVC system coupled to the control grid of V1 through a 1 megohm resistor.

After reaching the control grid of V1 (6BA6) the signal is amplified and coupled to the control grid of the mixer, V2A (triode section of 6CL8A). Here the signal is heterodyned with a signal in the 17 mc region coupled from the oscillator, V2B (tetrode section of 6CL8A). A difference frequency signal at 10 mc is selected by coil L4 in the plate circuit of the mixer, V2A and coupled to the grid of the second mixer in the I. F. strip.

The oscillator is a conventional Colpitts circuit which may be either crystal controlled or tuned over a limited frequency range when the RECEIVE SELECTOR switch is in TUNE position.

The second section of the receiver consists of a mixer and crystal controlled oscillator, intermediate frequency amplifier, second detector and noise limiter, and a special squelch circuit.

The 10 mc signal received at the grid of the second mixer, V3A, is heterodyned with a 10455 kc signal from the crystal controlled oscillator, V3B. The difference frequency of 455 kc is selected in the plate, circuit of V3A and transformer coupled to the control grid of the intermediate frequency amplifier, V4. The gain of this amplifier is also automatically controlled by the AVC system connected to the grid of V4 through the secondary of transformer T1 and 220 K ohm resistor R15.

The signal is further amplified in V4 and coupled from the plate through transformer, T2 to the plate of the detector, V5A, where the audio component is detected. V5A is also used to produce the AVC voltage. The detected signal is coupled to V5B which acts as a series-type noise limiter removing noise pulses which may ride through on the signal. The squelch circuit consisting of a neon lamp, NE-1, silicon diode, CR-1 and associated components is connected so that the audio section of the receiver is cut off and background noise eliminated when no signal is being received. The cut-off level may be varied by use of the squelch control, R-28.

The third section of the receiver is a conventional audio amplifier consisting of a twin triode audio voltage amplifier, (12AX7) V6A-V6B followed by a 6AQ5 (V7) tetrode power amplifier. When the transceiver is in RECEIVE position only one half of the 12AX7 is used. The second triode section V6B receives the audio signal from the center tap of the volume control R29. The audio signal is amplified in V6B whose output is RC coupled to the control grid of the power amplifier, V7. The audio signal is further amplified in V7. The plate of V7 is connected to transformer, T-3, which performs a dual function. In RECEIVE position this transformer acts as a normal output transformer with its secondary connected to the speaker. In TRANSMIT position, its function is that of a modulation transformer.

TRANSMITTER CIRCUIT DESCRIPTION

The transmitter is a two-stage unit consisting of a crystal controlled oscillator and neutralized tetrode final amplifier. The crystal oscillator is an electron-coupled Colpitts circuit with the crystal oscillating in the grid-cathode circuit. The oscillator uses INTERNATIONAL high stability, fundamental type crystals operating at one-half the desired transmitter output frequency. A three-position switch, TRANSMIT SELECTOR, is provided to select any one of three crystals, which may be installed within the unit. A channel 9 crystal is furnished with the unit and installed in one of the three crystal sockets.

The plate circuit of the oscillator is tuned to the second harmonic of the crystal frequency by coil L12. The oscillator output is coupled to the grid of final amplifier, V9, through capacitor C68. The plate circuit of V9 is a shunt-fed, pi matching network consisting of capacitors C71, C72 and coil L15. Neutralization is accomplished by capacitor C69 and link coil L13 coupled to the cold end of coil L12.

NOTE: Capacitor C61 which is a small plastic trimmer capacitor should not be adjusted, except by a technician with a commercial F.C.C. license, as this adjustment can effect the frequency of the transmitter.

POWER SUPPLY CIRCUIT DESCRIPTION

A three-way power supply is used in this transceiver. It operates as a conventional, full-wave rectifier circuit on all voltage inputs followed by a capacitor input RC filter network. On 6 or 12 volt battery operation, a vibrator circuit is used to provide the necessary AC voltage for the primary circuit of the power transformer.

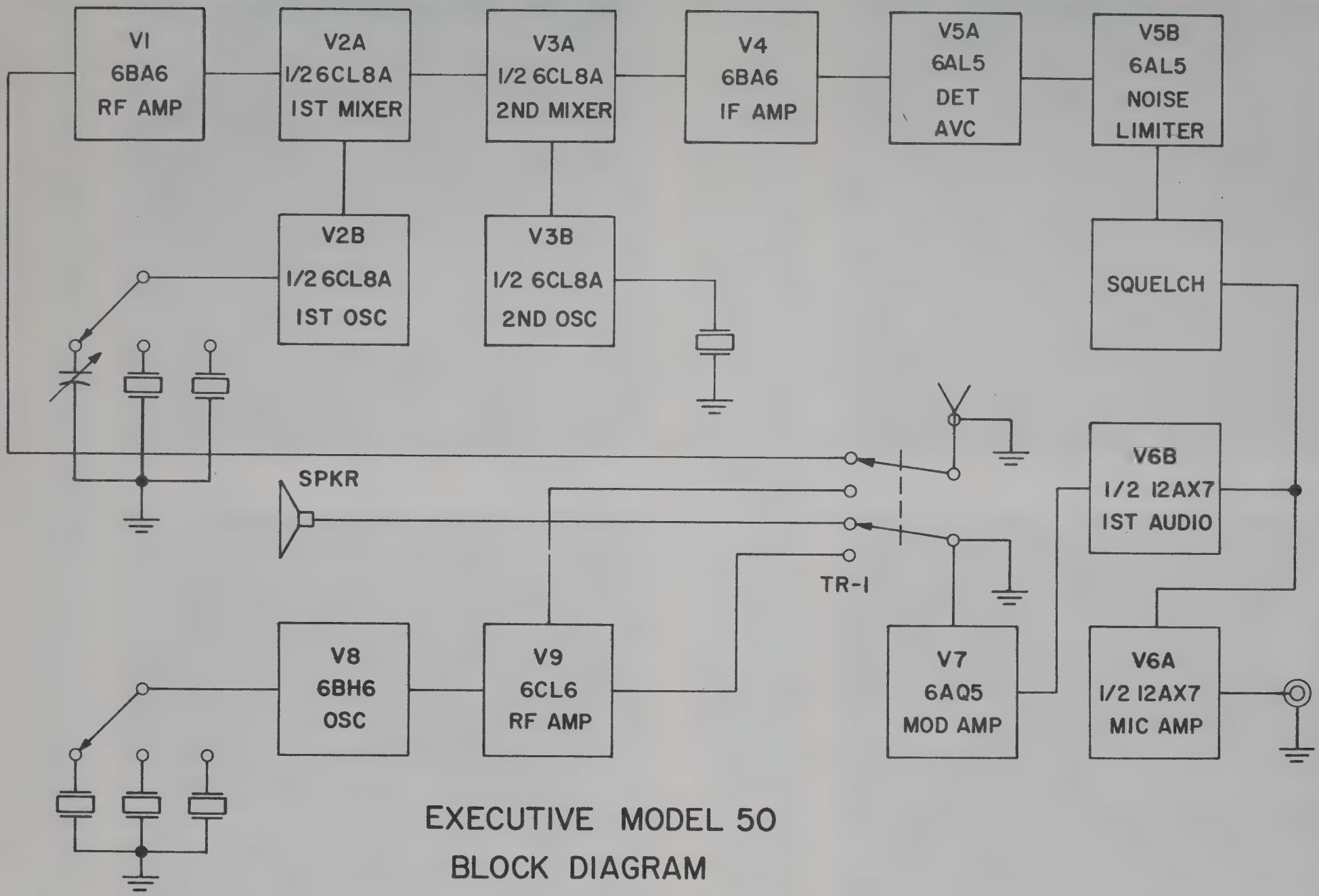
The transceiver is supplied with a power cord for operation from 115 volts AC, 60 cycles. The unit may be operated either from 6 volts or 12 volts DC by use of the proper power cord assembly which may be purchased from your dealer. The power supply is equipped with a thermal circuit breaker for protection on AC operation. For protection on 12 volt DC operation a 7.5 ampere fuse is used with the transceiver. Protection on 6 volt DC operation is provided by a 15 ampere fuse which is supplied with the unit. When 12 volt DC operation is desired the 7.5 ampere fuse must be substituted for the 15 ampere fuse.

TRANSMIT-RECEIVE RELAY CIRCUIT DESCRIPTION

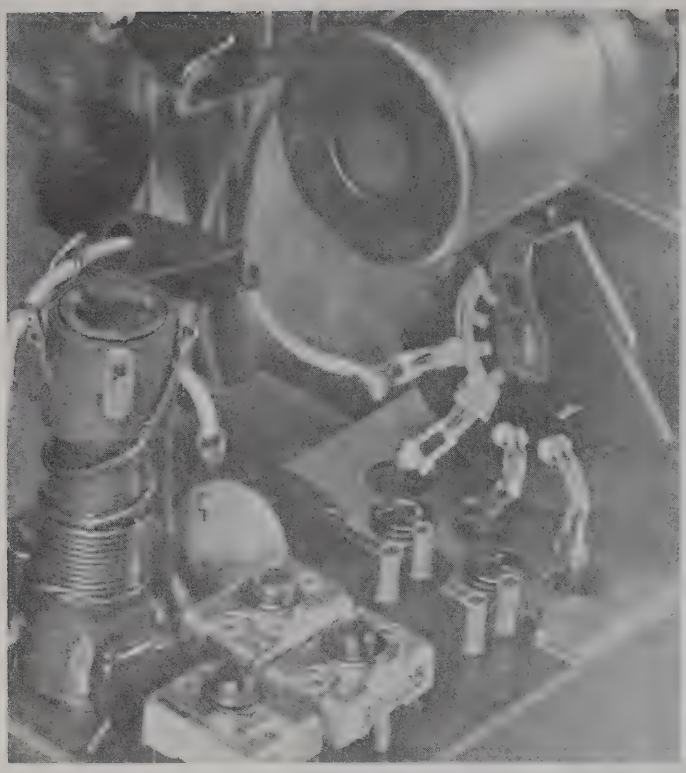
By including a transmit-receive relay (TR-1) in this transceiver, the many advantages of "push-to-talk" operation and maximum transfer of energy to and from the antenna are afforded the operator at no extra cost. The circuit consists of a half-wave rectifier which receives its AC voltage from a 6 volt secondary winding on the power transformer. The rectifier is followed by an RC filter network whose output is connected in series with one end of the relay coil. The other end of the relay coil is connected through the microphone socket to the microphone switch button. This completes the 6 volt DC relay circuit to ground and the relay performs the following switching functions:

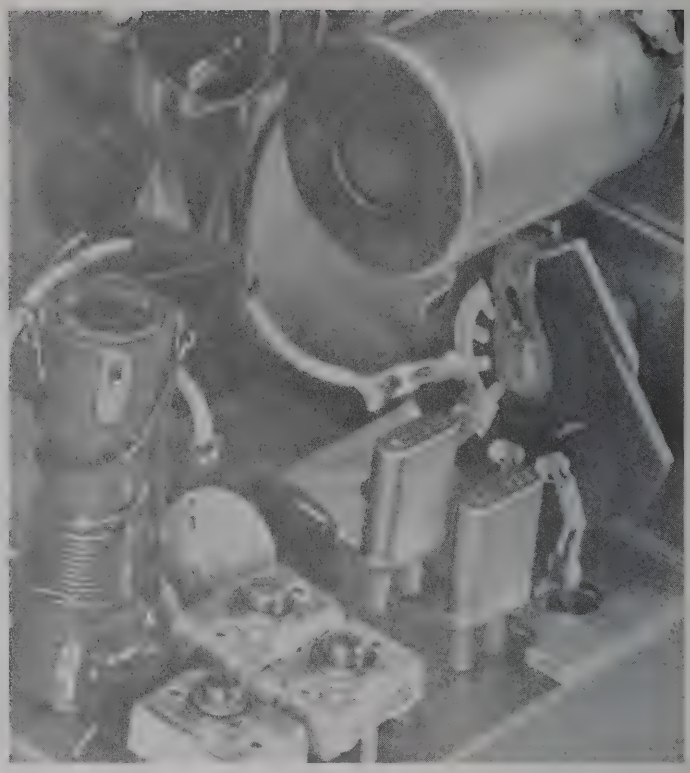
RECEIVE - In this position the relay is not energized and the antenna is connected to the receiver input, B+voltages are furnished to the receiver section and one side of the speaker is grounded.

TRANSMIT - The relay is energized and the antenna is switched to the transmitter output circuit, B+ voltages are furnished to the oscillator screen and plate circuits as well as V6A. The speaker voice coil is removed from ground and the cathodes of V6A and V9 are grounded.

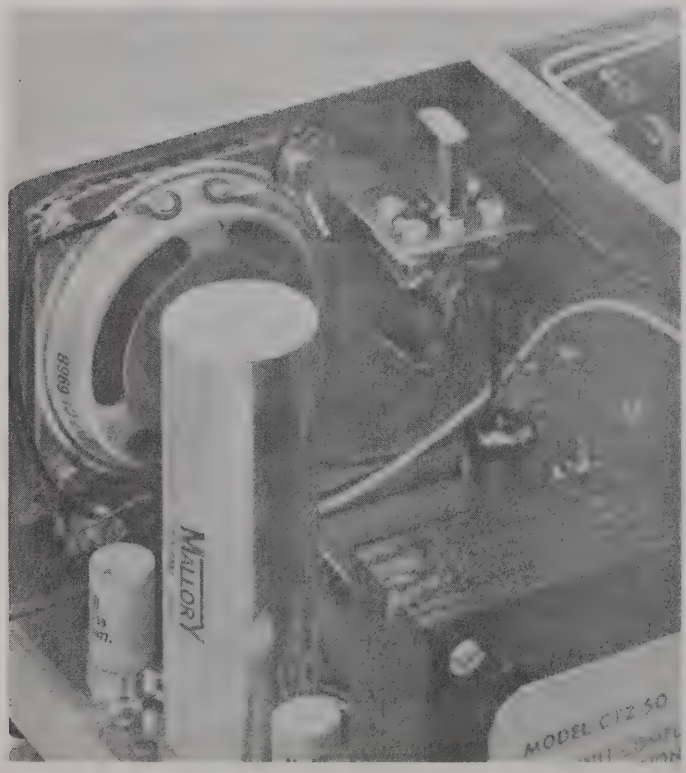


EXECUTIVE MODEL 50
BLOCK DIAGRAM





RECEIVER OSCILLATOR. The EXECUTIVE is delivered without receiver oscillator crystals (left photo) and may be operated to tune all 23 channels of the citizens band with the RECEIVE SELECTOR switch in TUNE position. For fixed tuning in either one or two channels install International type "R" miniature crystals for specific channels (right photo). The two crystals from left to right are controlled by positions #2 and #3 respectively on the RECEIVE SELECTOR switch. Type "R" crystals are listed in Section IV of this manual.



TRANSMITTER OSCILLATOR. The EXECUTIVE is equipped with one channel 9 transmit crystal (left photo). Additional crystals may be installed to permit transmission on either one or more channels. From left to right, the three crystals are controlled by positions #1, #2 and #3 respectively on the TRANSMIT SELECTOR switch. Transmit crystals are listed in section IV of this manual.

SECTION III
INSTALLATION

The actual placement of the EXECUTIVE unit makes very little if any difference, in its performance. In planning an installation the transceiver should be placed where it will save the most steps. For instance, if the unit is installed in a home to provide communications between the wife at home and her husband in the car, the basement would be a poor location. A more desirable location would be at or near the portion of the house where she spends most of her time, such as in the kitchen, den, or possibly the living room.

FIXED LOCATION INSTALLATION

Operation of the EXECUTIVE from any fixed location such as the home or office will always be best with an outside antenna. A full discussion of antenna selection is given at the end of this section.

MOBILE INSTALLATION

It is possible that the EXECUTIVE, when used in a car or other mobile application, may use a short, base loaded whip, mounted on the rear of the unit. It will not however, prove to be very satisfactory. For best results, a whip, mounted outside the vehicle is required. It may be mounted with a bumper mount on the rear bumper, or may be mounted on a rear fender or cowl, using a ball mount.

The EXECUTIVE itself should be mounted under the dash or in some other practical place in the vehicle. A special mobile mount, designed for the EXECUTIVE is available from INTERNATIONAL which allows the unit to be securely mounted to the car, yet be very easily and quickly removed. Information on this mount is given in the ACCESSORIES section of this manual. Various types of antenna mounts and microphones are also available from INTERNATIONAL.

Installations in cars, planes, boats or other locations near gasoline engines present special problems of their own due to noise created by spark plugs, distributor, voltage regulator and generator. A typical mobile installation is shown in Section IV. Measures which help reduce this noise are discussed at the end of this section.

VIBRATOR CARE IS IMPORTANT

With proper care, the vibrator used in the transceiver power supply for operation of the unit from 6 or 12 volts DC can be extended considerably.

When making a mobile installation the automobile voltage regulator must be adjusted for maximum generator charging rate of 7.3 volts on 6 volt systems and 14.7 volts on 12 volt systems. Equipment installed in vehicles having the regulator out of adjustment where the generator charging voltage exceeds 7.5 VDC on 6 volt systems or 15 VDC on 12 volt systems shall be considered out-of-warranty.

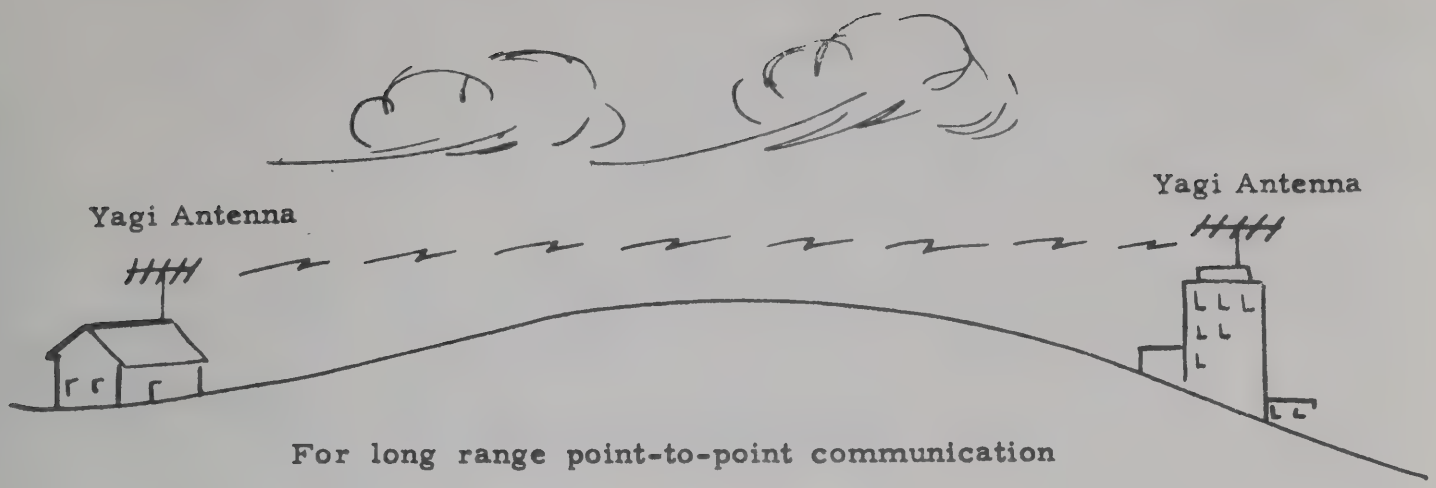
Excessive voltage causes vibrator contact arcing and eventually the contacts will fuse together. When this happens the fuse blows. The replacement of the fuse and vibrator will only be a temporary cure as eventually the same thing will occur again. As an extra safety factor, when the EXECUTIVE is used on 12 VDC the 15 amp fuse should be replaced with a 7.5 amp fuse.

Voltage should be checked at the unit with the engine at fast idle. If it seems as though the battery is fully charged, the lights should be turned on for several minutes without the engine running and immediately upon starting the engine the voltage should be noted. If it is excessive the voltage regulator should be adjusted BEFORE the equipment is permanently installed. In all cases the voltage must be checked when the generator is charging at maximum.

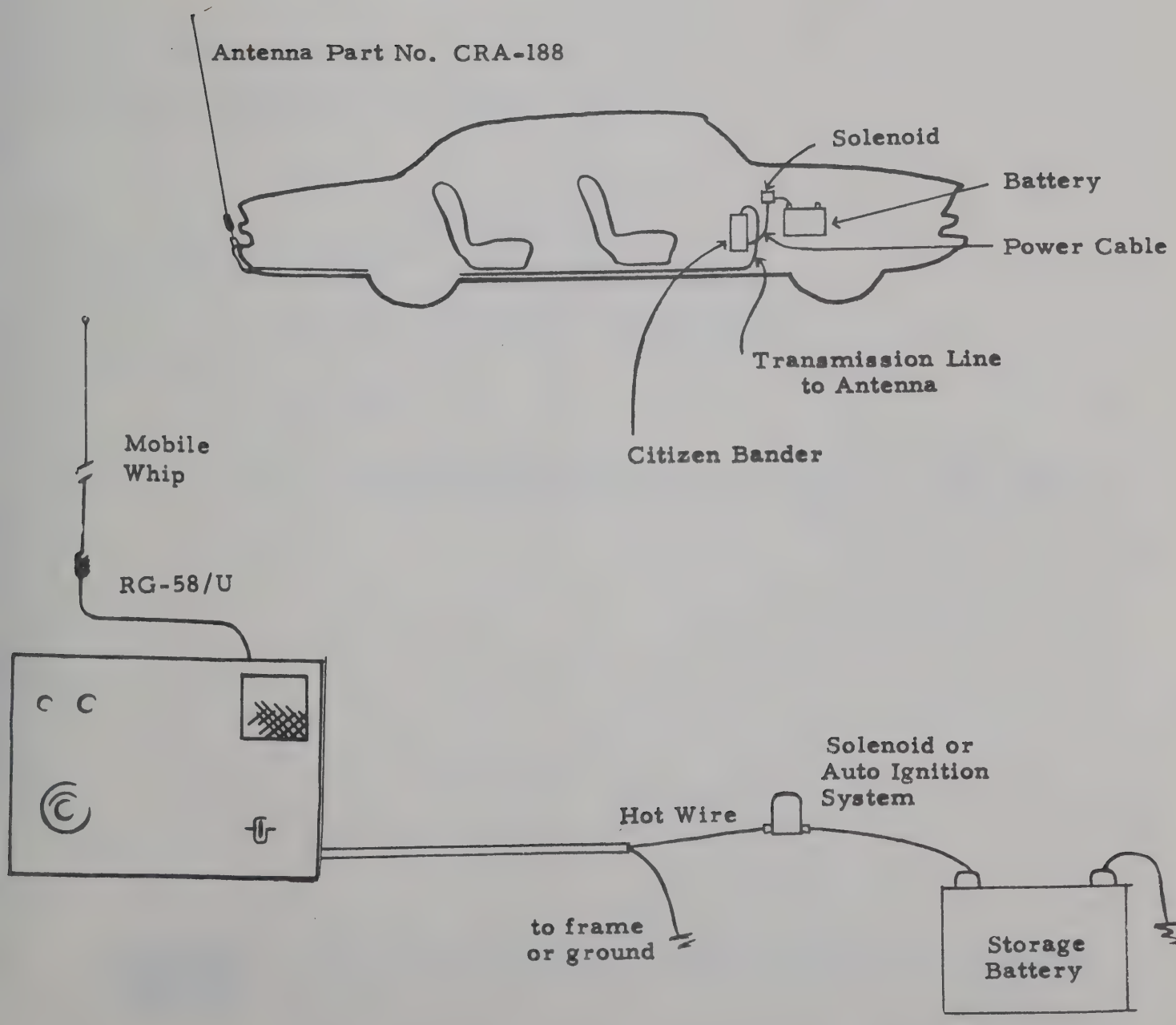
Vibrators have a thirty (30) day warranty, but if you check the voltage properly you will receive many months of trouble-free operation before needing vibrator replacements.

Also of interest is the fact that vibrator contacts will "stick" under a low voltage condition and all users should be advised that under no circumstances should the vehicle be started when the unit is on. Since a tremendous amount of current is drawn from the battery, voltage in some cases will drop to 50% of its normal value during the starting period which is sufficient time for vibrator failure to occur.

INTERNATIONAL will have available soon a test adaptor for use in making these voltage checks and suggest you watch for the announcement. In the meantime use your regular VOM or VTVM for this test. REMEMBER ..... check the voltage AT THE EQUIPMENT since poor connections or long cable leads will be the cause of a low voltage condition.



For long range point-to-point communication



Typical Mobile Installation

AUTO RADIO NOISE REDUCTION TECHNIQUES

by "Bill" Ashby K2TKN
Cornell-Dubilier Electronics Div.

for AMATEUR CITIZENS BAND AND COMMERCIAL SERVICES

CDE
CORNELL-DUBILIER ELECTRONICS DIVISION
FEDERAL PACIFIC ELECTRIC COMPANY
NEWARK NEW JERSEY

Auto Radio Noise Reduction Techniques

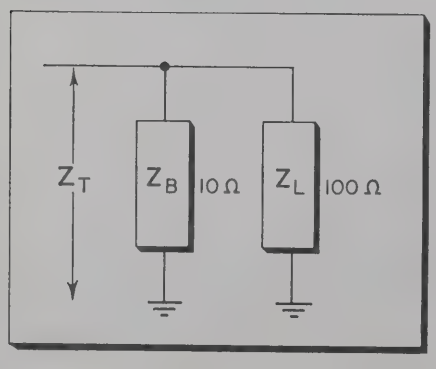
Coaxial Type Capacitors Prevent Ignition Noise From Interfering With Radio Reception

WILLIAM ASHBY
Cornell-Dubilier Electronics Div.

• A natural byproduct of an automobile's (or marine craft's) ignition system is an r-f signal that interferes with radio receiver reception. Any part of the ignition system that sparks due to make-break electrical contacts can be an interference offender, which includes the distributor, voltage regulator, and spark plugs.

One method employed to reduce noise due to contact arcing is the *confinement* method. Here, any source of noise is isolated and the entire area is completely shielded to prevent r-f radiation. Although this procedure is effective, it is a relatively expensive way to reduce interference. In most cases, noise due to spark discharge, arcing contacts, generator brushes, etc., can be economically reduced to reasonable levels by noise *suppression* methods. This is accomplished by bypassing r-f energy to B- through capacitors.

Fig. 1—To be highly effective a bypass capacitor's r-f impedance should be small compared to the r-f load impedance.



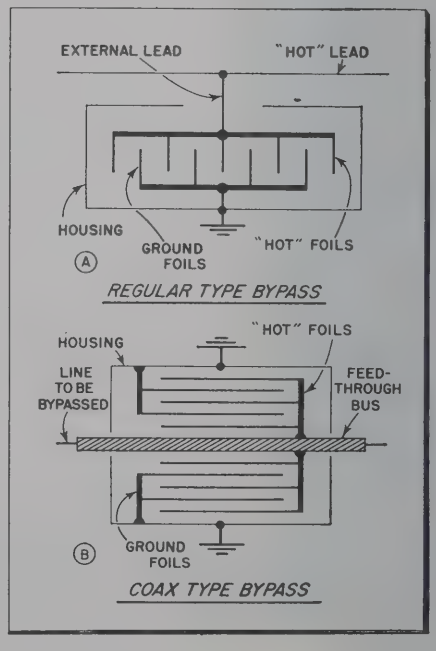
Noise Suppression Capacitors

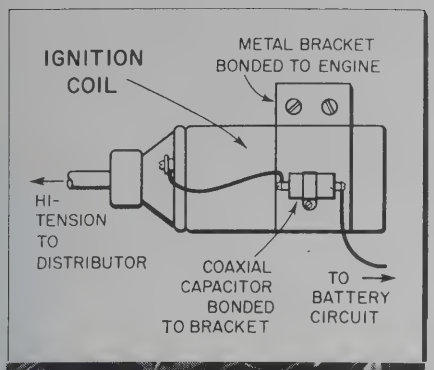
Noise suppression capacitors are utilized to prevent ignition noise from entering the receiver and, thereby, causing static. This can be accomplished with conventional bypass capacitors that are specially enclosed in weather-proof metal housings which also act as a "ground" lead. Their effectiveness depends on actual circuit conditions. That is, capacitors have different load impedances to r-f at the point of bypass. This results in varied noise component bypassing abilities. Further, their bypassing effectiveness greatly diminishes in Citizens Band and FM receiver megacycle frequency areas.

In order for a bypass capacitor to be effective when shunted across a load, Z_L, the bypass impedance, Z_B, should be relatively small. As shown in Fig. 1, the bypass impedance, including capacitance and lead inductance, forms a parallel circuit. The bypass effectiveness may be calculated by considering the reduction in total impedance, Z_T, caused by shunting the bypass across the load. For example, a Z_B of 10 ohms placed across a Z_L of 100 ohms reduces the Z_T from 100 to 9.1 ohms: $(10 \times 100)/(10 + 100)$. So the bypass effectiveness is 90.9%. If, however, Z_B were 10 ohms and Z_L were only 1 ohm, a similar calculation would show only 9% effectiveness. Cross sectional basic structure of a regular type bypass capacitor is shown in Fig. 2.

A better capacitor for noise suppression is the co-axial or feed-thru capacitor. This capacitor is designed to completely surround the conductor carrying the r-f component. Since r-f currents travel on the conductor's surface, removal of the noise component is more effec-

Fig. 2 (top) Basic structure of a regular type bypass capacitor, and (bottom) coaxial type structure which provides more effective filtering at higher frequencies.





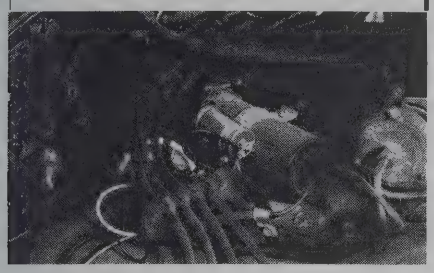


Fig. 3 (top) Drawing of ignition coil terminals, cables, and proper placement of coaxial capacitor. (Bottom) Spark coil with coaxial capacitor securely attached and grounded to coil's mounting strap.

tive using co-axial capacitors than conventional bypass capacitors (See Fig. 2).

Receiver Installations

When a technician installs a receiver in an auto or boat that has not been properly prepared for noise suppression, he must naturally accomplish this work, too. The freedom of static displayed by the receiver he installs will be largely determined by his installation and noise suppression considerations.

To begin with, mobile radio equipment must be correctly installed according to manufacturers' instructions. All equipment must be properly bonded to ground, and shielded cable having adequate size wire must be used from the d-c supply source to the equipment. Secondly, ignition suppressors or resistor type spark plugs—plus a distributor suppressor will minimize r-f radiation.

Particular care should be taken to properly bond the engine in several places directly to the main frame or common ground system. Heavy tinned copper braid should be used for bonding. This reduces radiation from the engine itself. Metal parts in proximity with the ignition system should also be bonded to the engine block. All metal-to-metal connections, such as the metal case of an ignition coil, should be cleaned and firmly bonded to the engine. All bonding leads should be as short as possible. All metallic hose lines, mechanical linkages, etc. from the carburetor or engine accessories, should be similarly treated. Exhaust pipes should be bonded to the engine frame in several places.

Eliminating Interference

After the receiver has been installed, together with the proper antenna, the technician faces the "acid" test: is there any static interference? If a sharp, "popping" pulse type noise is heard in the receiver when the engine is running, try a 0.5 μf, 40 amp, 50 volt coaxial capacitor at the spark coil as shown in Fig. 3. Remove the low voltage primary wire (battery cable) from its terminal on the spark coil. Bolt the capacitor directly to the coil mounting bracket—as close to the coil terminal as possible. Connect a very short lead from one end of the capacitor to the spark coil primary terminal. Attach the previously removed primary wire (battery cable) to the opposite end of the coaxial capacitor.

Start the engine. While it is running, loosen the generator bracket and relieve tension on the drive belt until the generator stops turning. Turn on the radio receiver—with the squelch or noise clipper controls turned off. Tune the receiver to a weak signal. Listen for the "popping" pulse type noise which will vary with engine speed. The noise should be greatly reduced and weak signals should be much stronger than the noise.

Re-tighten generator bracket so that the generator is again operating normally. Listen for a grinding noise or "whine" from the receiver. If present, this interference will probably be caused by sparking at the generator brushes.

To reduce this type interference stop the engine and remove the generator. Clean mounting bracket and bosses to insure good bonding of the generator to engine block ground. Bond the generator and its mechanical mounting to the block with heavy braided strap. After the generator is replaced, install a 0.5 μf, 40 amp, 50 volt coaxial capacitor close to the armature terminal on the generator, as shown in Fig. 4. Make certain the capacitor mounting bracket makes clean contact with the generator frame. Attach the shortest possible lead from the generator's voltage regulator terminal to one side of the capacitor. Attach the voltage regulator cable to the other side of the capacitor.

Start the engine again, and tune in a weak station on the receiver.

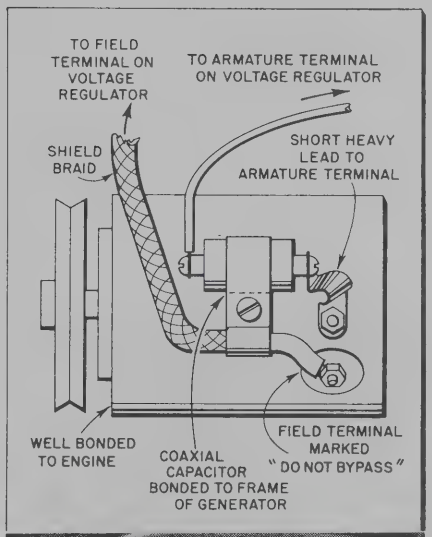

TO FIELD TERMINAL ON VOLTAGE REGULATOR
TO ARMATURE TERMINAL ON VOLTAGE REGULATOR
SHIELD BRAID
SHORT HEAVY LEAD TO ARMATURE TERMINAL
WELL BONDED TO ENGINE
COAXIAL CAPACITOR BONDED TO FRAME OF GENERATOR
FIELD TERMINAL MARKED "DO NOT BYPASS"

Fig. 4 (top) Drawing of generator terminals, cables, and coaxial capacitor placement. (Bottom) Generator armature is connected to coaxial capacitor with short heavy copper lead. Generator field cable is shielded from terminal to voltage regulator.

The generator brush noise should have disappeared or dropped to a very low level. Overall noise from high level sources should now be well below the bothersome level.

When spark coil and generator noise have been reduced, other low level noise may become apparent. An intermittent, rough, "burping"

Auto Radio Noise

noise can originate in the voltage regulator. This can be reduced in the following manner:

Obtain a metal box large enough to contain the voltage regulator, with sufficient additional room for 2 bulkhead mounting type feed-thru coaxial capacitors. Capacitors should be .25 μf rated at 20 amp, 200 volts. Mount the two capacitors in holes drilled in one end of the box, as shown in Fig. 5. Two short leads are connected from each capacitor to the regulator's generator and battery terminals respectively. The generator and battery leads are then connected to the proper capacitor terminals on the outside of the regulator shield box as shown.

Do not use a capacitor on the generator field lead. A piece of braided cable shield should be pulled over this lead, from the shield box to the generator. The braid should then be bonded to the generator frame and to the regulator shield box (see Fig. 2 also). Regular coaxial cable connectors may be used on this cable at the regulator shield box to facilitate bonding and connecting. This operation should reduce regulator "burping" to a very low level.

Brush-type motor interference from windshield wiper, fan, blower, etc., can be quickly isolated by switching them on-and-off while listening to weak signals on the receiver. Any offending device should first be bonded to the main frame or ground. Install a specially designed bypass capacitor rated at .25 μf, 100 d-c volts as close to the low voltage terminal as possible (see Fig. 6).

On equipment in non-metallic marine hulls, run a very heavy main ground—a copper plate at least four inches wide from stem to stern along the inside hull—as far below the water line as possible. Bond all metal used on the boat to this ground. Use heavy copper braid. Bond engine block, drive shaft, rudder posts, etc. directly to the main ground strap. Every piece of metal in contact with the water must be bonded to this common ground.

A check of the effectiveness of the steps that have been taken to eliminate interference to radio reception can easily be made by observing noise being radiated by other idling or moving vehicles. They will generate much more noise in your receiver than your own engine—unless they have been equally "de-noised." •

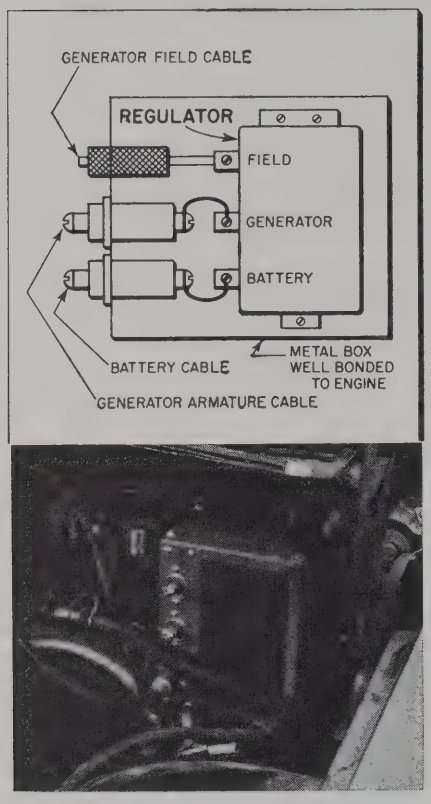


Fig. 5 (top) Regulator, terminals, and coaxial capacitor placements in shield box. (Bottom) Regulator shield box showing standard coaxial cable connector at end of generator field cable.

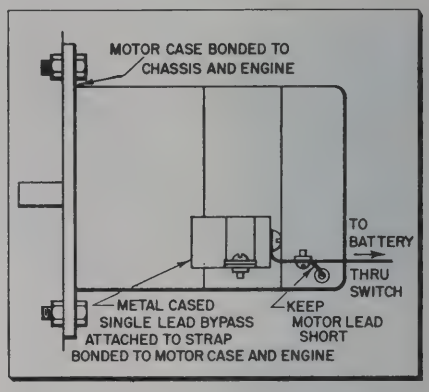

MOTOR CASE BONDED TO CHASSIS AND ENGINE
TO BATTERY
THRU SWITCH
METAL CASED SINGLE LEAD BYPASS ATTACHED TO STRAP BONDED TO MOTOR CASE AND ENGINE
KEEP MOTOR LEAD SHORT

Fig. 6—Method of mounting special type bypass capacitor to eliminate interference from accessory motors.

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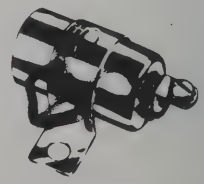
CORNELL-DUBILIER CAPACITORS
FOR AUTO RADIO NOISE REDUCTION

For Coil and Generator
0.5 Mfd, 50 VDC, 40 Amp.
Catalog No. NFF-055B
List Price $3.50

For Voltage Regulator
*0.1 Mfd, 600 VDC, 20 Amp.
Catalog No. NFF-315D
List Price $2.95



For Accessories
*0.1 Mfd, 100 VDC
Catalog No. MC-8D98
List Price $2.38

*At frequencies above 2 MC, the less expensive 0.1 Mfd. units have been found to be just as effective as the 0.25 units recommended in the text.

ANTENNAE AND THEIR SELECTION

The most common antennae for citizen use are the Ground Plane and Coaxial for base use and the Vertical Whip for mobile use. The Yagi multi-element beam antenna can be used to great advantage where point-to-point communication is required rather than non-directional coverage from the base station. Any antenna with a directional gain will effectively increase the radiated power of the transmitter as well as the received signal applied to the receiver.

It is best to purchase a good commercially built antenna rather than attempt to construct your own. Good commercial antennae have low SWR (standing wave ratio) which is a merit of the radiation efficiency. With home constructed antennae it is sometimes difficult to effect a good match between the antenna and the transmitter causing considerable power to be lost in the system. An antenna should have an SWR of no more than 2:1.

Some power will be lost in the transmission line and therefore long runs should use the larger RG-8U cable. This cable has a lower loss per foot than the smaller RG-58/U. Both types have a characteristic impedance of 53 ohms. Loss per 100 feet at 27 megacycles is 1 db for RG-8/U and 2 db for RG-58/U. For short runs the RG-58/U cable is more easily handled.

Most of the antennae are available in two grades. The lower priced standard grade will not be as mechanically strong as the commercial grade. Electrically both grades are usually about equal. Where ice loads, wind, and salt air are a factor it will be cheaper in the long run to purchase the better antenna.

For extremely short range communication (less than a mile) the base loaded case whip antenna works very well. With two units using case whips, the signals will become quite weak after a block or two and poor squelch operation will be encountered. The outside antenna is by far the best choice and should be mounted as high as practical and still be within F.C.C. regulations. [Paragraph 19.25(c)]. In brief, the F.C.C. limits antenna height to no more than 20 feet above an existing structure or not to extend above the top of the radiating element on an existing tower. Remember the Yagi type antenna is usually mounted in a horizontal position. This type antenna must be used with another antenna mounted in the same plane. If the Yagi is to be used to communicate with mobile units using a whip antenna, the Yagi should be mounted in a vertical plane. A little thought in antenna installation will greatly improve your coverage.

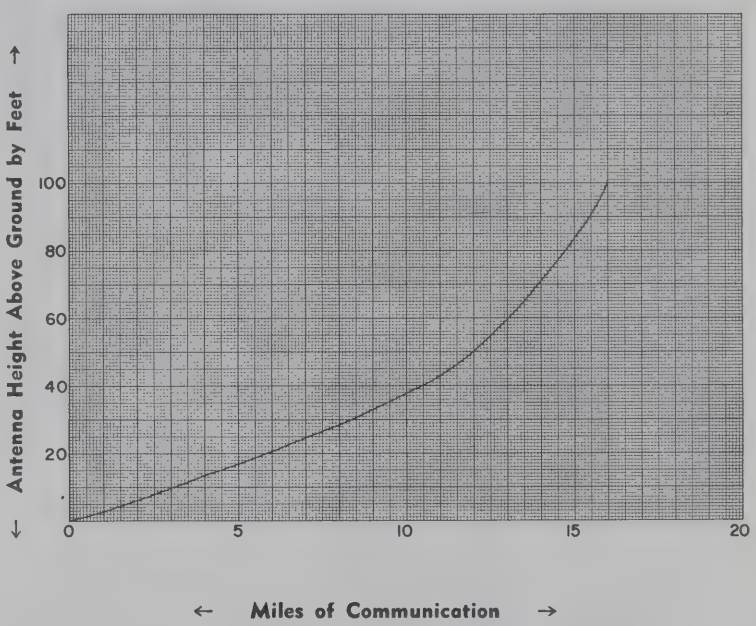
DISTANCE vs ANTENNA

The direct coverage you are able to obtain using Citizen Equipment in the 27 megacycle band will depend a great deal upon the antenna. We shall speak of direct coverage rather than skywave coverage wherein you may communicate 500 to 2000 miles at various times.

The F.C.C. has intended the Citizen use to be for short range communication and all installations should be calculated on this basis. The following charts consider a base station antenna mounted on a mast with the calculated range to a mobile unit using a standard 108" whip. Remember that the antenna may be mounted on an existing structure or mast [reference F.C.C. 19.24(c)].

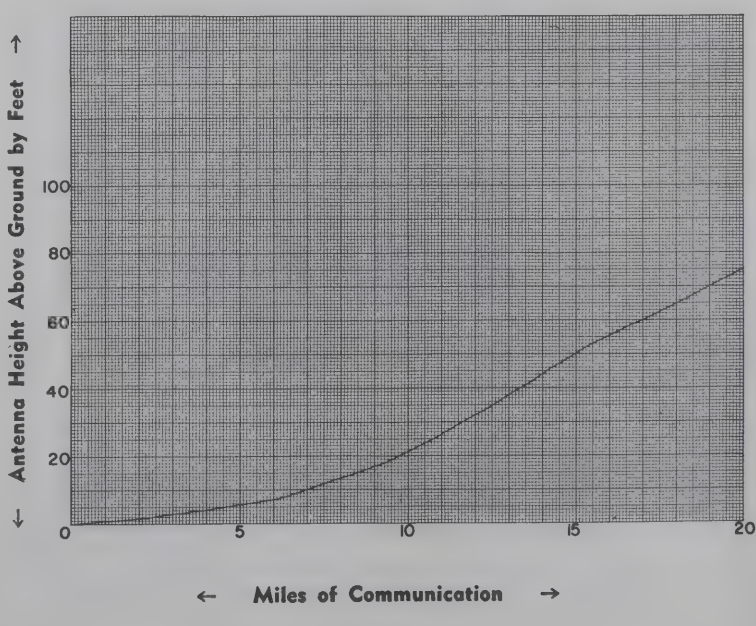
Ground Plane or Coax Antenna For 2 Microvolts at Receiver

Chart #1



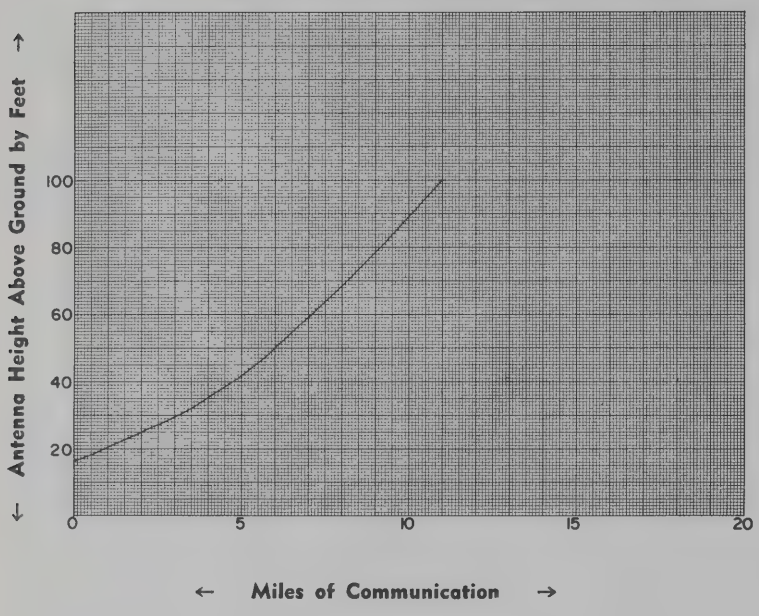
Yagi Antenna Mounted Vertical For 2 Microvolts at Receiver

Chart #2



Ground Plane or Coax Antenna For 15 Microvolts at Receiver

Chart #3



Note how the distance increases with increase height of the antenna for a given installation as in Chart 1. If a direction antenna is used as in Chart 2 you can see how the distance is further increased, however, this reduces the area covered since the Yagi Antenna is quite directional.

Charts 1 and 2 are based on a 2 microvolt signal at the receiver. This signal will not be sufficient for many city areas where high levels of noise exist. Chart 3 considers the coverage for 15 microvolts at the receiver and is more practical for general city use.

When the Citizen frequencies are open to skywave transmission, signals from distant stations will be strong enough to over power weak direct signals. When one is considering communication he should understand that for 100% contact he should base the calculations on 15 microvolts or more.

In mobile communication dead spots will be found at various points as well as locations giving excellent signals. These points should be noted and contacts made from the best possible locations. Vehicle noise and electrical interference will greatly reduce your communicating distance.

ELIMINATE YOUR MOBILE "NOISE GENERATORS"

Now that low cost TWO-WAY radio communication is available to everyone with the opening of the eleven meter band for Citizen use the number of mobile installations will probably exceed the number of base, or control, stations by a factor of 5 to 1 within the near future. It is estimated there are now over 160,000 citizen band mobile installations and approximately 45,000 base, or control, stations in operation. Proper installation and necessary steps towards the elimination of electrical, and mechanical, interference inherent in all motor vehicles is of prime importance if distances of three miles or more are desired to be covered.

For short range coverage the simple installation of a "radio condenser" on the generator and the "interference suppressor" installed in the top of the distributor, or coil, is usually sufficient noise suppression. But when maximum distances of three or more miles must be covered, great pains must be taken and all known means of noise suppression must be used. Different makes and models of vehicles will require different means of noise suppression. Some models only the very simple, others will need the "all out" method.

As there are numerous "generators" of radio interference in every motor vehicle the elimination of one source may not be noticeable as it's noise level may be below one you have not located so the proper way to approach your "noise" problem is by a systematic process of first suppressing all known offenders, namely the generator, voltage regulator, distributor and spark plugs.

We will explain throughout this article what is considered to be the proper vehicle noise suppression methods. The volume of noise you can, or will, tolerate in your receiver will depend upon the amount of suppression applied. Few installations will require the "all out" method and the user must decide when he is satisfied.

The purpose for eliminating your own "noise generators" is the fact that your receiver's automatic volume control (AVC) will react to these random noise pulses the same as though a strong station was tuned-in and will cut the receiver's sensitivity way down which will eliminate the weak stations you normally wish to copy. There's an old saying "if you can't hear them, you can't work them."

Let's start our "noise elimination" with the generator and voltage regulator. The generator is the item that causes the whine as the speed of the motor is increased. It is very easily detected by speeding up the engine and then cutting the ignition off. The instant the switch is turned off ONLY the generator and voltage regulator can cause the noise as all other "noise generators" are eliminated when the switch is off EXCEPT the generator as it is still in operation and is still trying to charge the battery through the voltage regulator. Even though it will operate only a few seconds after the switch is off this is time enough for you to hear the terrific amount of noise it is generating. As the speed of the engine decreases the whine will decrease in unison.

Practically all vehicle manufacturers cable the two leads from the voltage regulator to the generator in a harness with other wires. It is recommended that both of these wires be run in **separate** tinned copper braid. Just disconnect the present wires from the generator and the other end of them at the voltage regulator's "A" and "F" terminals. They can be cut-off where they enter the harness or just taped down out of the way.

A Sprague 48P18 coaxial capacitor, or a similar .5 mfd coaxial capacitor, should be installed directly ON the generator and the lead from the condenser to the battery armature terminal of the generator must be as short as possible. In fact a length of one inch is sometimes too long. A .001 mfd mica capacitor should now be installed from the same battery terminal to the frame of the generator, here again lead length is extremely important and they should be no longer than one-quarter inch. Be sure to remove paint and grease on the generator where the capacitor is bolted as a "good" ground at this point is necessary.

Dress the cable from the coaxial capacitor on the generator against the body of the car. Use speed clips to keep in place or run through presently installed cable clamps. This cable is usually the longest "noise generator" we must suppress and it is preferred to shield this wire in tinned copper braid. The end of the braid must be soldered directly to the coaxial capacitor's body. Be sure to use size #12 copper stranded wire when making-up this new lead. Connect a new cable to the generators' "F" (field) terminal and run this lead in a tinned copper braid shield and dress it along side the battery lead. This new lead may be of size #16 copper stranded wire.

The voltage regulator is next and the "job" from here on is usually easy compared to the one just completed. Remove the cover from the voltage regulator and clean off any paint that may insulate the cover from the frame. Check the mounting screws and be sure the regulator is being grounded directly to the firewall. If necessary remove and clean away any paint so you may secure a "perfect" ground connection.

Use two 48P3 of 48P5 Sprague coaxial capacitors or similar .1 to .5 mfd coaxial capacitors and install at the "A" and "B" terminals of the regulator. The capacitors metal body must be grounded directly to the firewall. This can be easily accomplished by using a piece of cadimun plated metal about 4" x 4" bent to a 90° angle. Drill two holes for the capacitors and two holes to pass sheet metal screws to bolt to the firewall. Attach the capacitors to the angle with screws and nuts and **also** solder. Locate the assembly so the lead from each capacitor to the "A" and "B" regulator terminals are extremely short. Be sure to clean the paint from the firewall so the bracket will make a good solid ground connection. Attach the cable from the generator's "F" terminal to the voltage regulator's "F" terminal. Connect a .002 mfd capacitor and a 4 ohm resistor, in series, from this point to ground. Again, lead length is important and the overall length of the capacitor-resistor combination must be as short as possible. Attach the lead from the generator's armature terminal to the coaxial capacitor connected to the voltage regulator's "A" terminal. The shielding braid on these leads must be grounded to the capacitor bracket or to the firewall by soldering or with the use of washers and sheet metal screws. Attach the "B" battery lead to the coaxial capacitor connected to the "B" terminal of the voltage regulator. This is the lead coming through the firewall and usually goes direct to the battery charging indicator on the vehicles dash panel.

The next superb "noise generators" of them all are the spark plugs. But here we have available to us years of research for only a few dollars. Just go to your local auto supply store and purchase a complete set of AUTO-LITE RESISTOR spark plugs that are direct replacements for your particular brand and model of vehicle. CAUTION: We own no stock in Auto-Lite, but please accept no "substitute" as some **resistor** plugs will actually increase your noise problem. Be patient, if your dealer does not stock your size just ask him to get them for you. When installing the new plugs be sure to have the gap properly set.

After **properly** installing the "recommended" suppression to these trouble makers you should be able to drive comfortably and communicate with stations you never heard before with your engine running. However, in most cases this is only the beginning of the job in order for you to say that you have a good mobile installation.

If you have been checking your "noise elimination" progress as you complete each step we know you will be extremely pleased with your work. But from here on each suppression job will not be very noticeable until you hit the one big joker that's causing a lot of trouble. The little "noise generators" will be obscured by this one and wouldn't have showed up until it was eliminated. All-in-all the little ones can really add up and must be taken care of in due time.

Have your distributor checked to see that the capacitor across the breaker points has the proper capacitance and the points are properly set. If the vehicle has been driven 30,000 to 40,000 miles or more it is recommended that the distributor cap and rotor be replaced. This will usually not only reduce the ignition noise, but also improve the overall performance of the engine. At the same time have the timing checked and properly adjusted.

When purchasing your new AUTO-LITE resistor spark plugs also buy enough 4,000 ohm-per-foot ignition cable to make up a new wiring harness from the distributor to the spark plugs. Be sure that the new terminals (ferrules) are installed whereby they make **good** contact with the center conductor of the new cable. It is preferred that the ferrules be soldered rather than crimped on as there is danger of a poor contact causing another "noise generator" to appear.

Check your ignition wiring by shorting out each plug, in turn, while listening to the receiver. Any reduction in the noise level will usually indicate that the ferrules are not making good contact in the distributor head, or the ferrule and center conductor should be soldered.

Install a 10,000 ohm carbon suppressor in the distributor's center terminal and make up a new lead to run to the coil. Here again be sure the ferrules are soldered and are making a "tight" connection inside the coil and distributor. A new lead is recommended here as any breaks what-so-ever in the ignition system's wiring insulation could be a source of "ignition noise." With very short leads connect a .001 mfd disc ceramic capacitor from the coil's battery terminal to the coil's case.

Bonding braid should now be run from the fire wall, coil, and the distributor to the engine. Use as short a piece of braid as possible in each case. If the ground lead of the battery is attached to the fire wall it should be removed and attached to the starter mounting bolt. The power cable ground lead for your transceiver should also be connected at this same point. Usually the hot and ground leads from the battery go direct to the starter's

solenoid which is mounted on the starter and this is a good place to connect the transceiver's power cable. CAUTION: Remove the hot cable from the battery before making connections to the starter as there is danger of the hot battery cable getting loose and shorting out the battery or even starting a fire.

Connect a short piece of bonding braid across each engine hood hinge. NOTE: The hood will act as a shield to help keep the engine noise inside the engine compartment and away from your antenna. Next connect a short length of bonding braid across each trunk lid hinge, front of the engine to the frame, exhaust tail pipes to the frame, and a piece of wire braid from the air cleaner to the fire wall. It is very important that we caution you to be sure that you clean away all paint, grease or insulation material when installing the grounding braid as **good,** low resistance, ground connections must be made.

Noisy tires should be treated with an anti-static powder, brake shoes grounded to the backup plates with bonding braid and static collectors installed inside the front wheel grease retainer cups. Heat and oil indicator sending units on the engine must be by-passed with .1 to .5 mfd capacitors, again using very short leads. All instrument panel gauges and accessories should be by-passed using .5 mfd capacitors. Heater and defroster motors, electric windshield wiper motors and any other accessory motors by-passed with a .25 to .5 mfd capacitor. The gasoline sending unit mounted on the gasoline tank must be by-passed with a .1 to .5 mfd capacitor. An inspection plate is usually provided in the trunk compartment over the tank.

For the person who desires the "ultimate" in mobile "noise elimination" there are available for some vehicles marine and aviation spark plugs that could be used and the complete ignition system shielded by using these plugs and making metal boxes to enclose the distributor and coil, and shielding all wiring associated with the ignition system. By having the ignition system **completely** shielded most of the "suppression" can be eliminated and the normal high engine performance will be maintained.

You should set aside a week-end for your "noise elimination" project and have all necessary parts and tools available. You may visit your local two-way radio communications company and secure most of the parts required in kits furnished by some manufacturers of two-way radios. The other parts required are available from radio parts supply and auto parts supply firms.

Lay out your line-of-attack and as each "noise generator" is suppressed it should be noted and checked by listening to the receiver or noting the receiver's "S" meter indication before and after the suppression. This indicates the noise level entering the receiver that is being picked-up by the antenna. To check the noise level entering the receiver by the antenna connecting cable disconnect the cable where it connects to the antenna and short the cable's terminals. If noise is still noticeable it will be necessary to re-route the cable under the vehicle and up through the fire wall to the transceiver. Check the noise level entering the receiver through the power cable by disconnecting the antenna connecting cable at the receiver. All noticeable noise in the receiver is now being picked-up by the power cable and fed to the receiver. This can usually be eliminated by installing a Sprague 48P3 feed-thru coaxial capacitor on the fire wall and the hot battery lead from the transceiver connected through the capacitor to the battery terminal.

We sincerely hope that we have been of some help to you and assure you that when you finish your "noise elimination" project you will consider yourself an "**expert.**" But just as a parting reminder, remember that all of those cars along side of you, up front, behind and the ones passing have not been through the "elimination" process and it will be up to your receiver's built-in noise limiter to cut **their** noises down to a listening level that is bearable.

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From Class "D" Citizens Band Radio 1960 Call Book

SECTION IV

ACCESSORIES

MMR-1 MOBILE MOUNT

Available from INTERNATIONAL is a mobile mount designed with the customer's convenience in mind. This accessory permits the transceiver to be installed or removed from the car by simply pulling the unit out, much in the same manner as an ash tray. Details of the mount are shown on another page in this section.

ANTENNAS

Without an efficient antenna, operation of your Executive is not as enjoyable as can be experienced with a well designed antenna system. INTERNATIONAL has available antennas for almost any installation.

12 POSITION TRANSMITTER SWITCH

For those who may desire the convenience of more than three transmitting crystals, INTERNATIONAL now has a crystal switch assembly which accommodates 12 crystals. This unit is easily installed and is nominally priced. Cat. No. 150-163.....$7.50

EXECUTIVE CRYSTALS

Crystals for the preceeding crystal switch assembly and all other Executive units are also available for transmitting and receiving channels 1 to 23. Frequency and part numbers of these crystals are listed on another page in this section. Price Each $4.75

POWER PLUGS

For our customers who have only one unit and wish to use it in several different locations, INTERNATIONAL offers three different power plugs which will allow the Executive unit to be used anywhere.

6VDC plug	Part No. 150-118	Price Each.....$7.50
12VDC plug	Part No. 150-119	Price Each.....$7.50
115 VAC plug	Part No. 150-120	Price Each.....$7.50
DC plug Kit	Part No. 150-191	Price Each.....$3.95
AC plug Kit	Part No. 150-192	Price Each.....$3.95

MMR-1
Mobil Mounting Rack

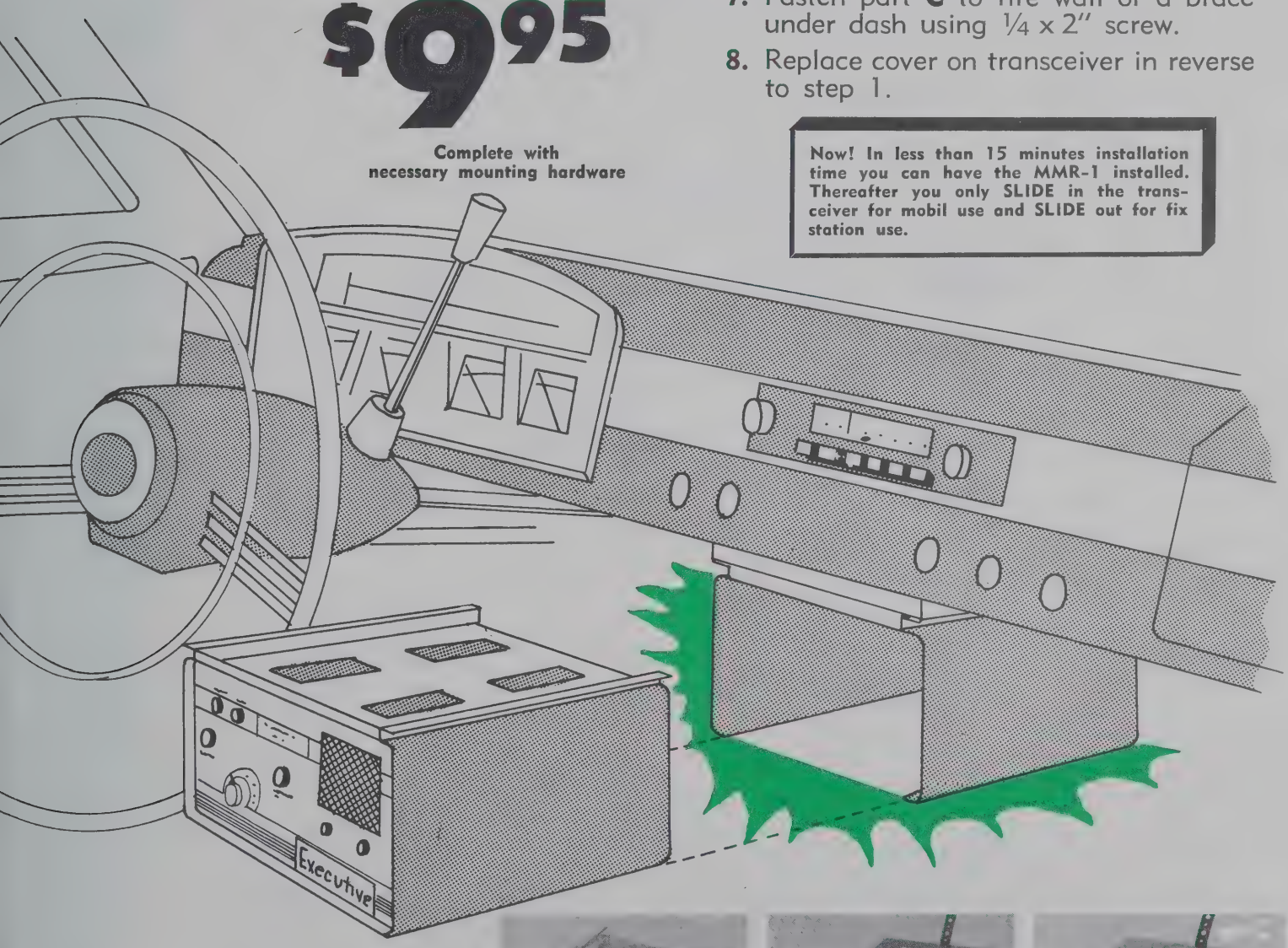
ONLY
$9.95

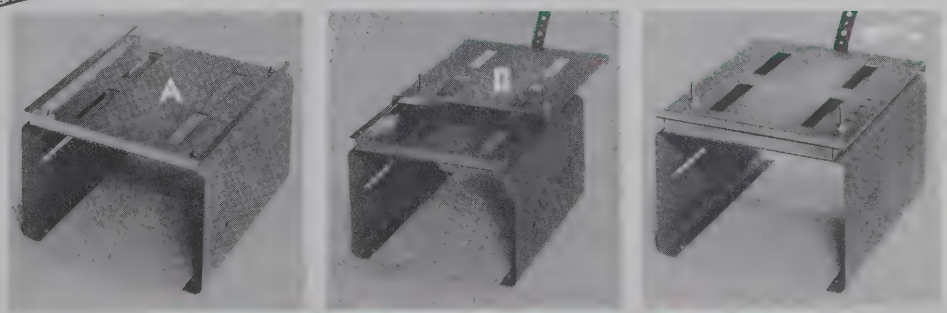
Complete with necessary mounting hardware

INSTALLATION INSTRUCTIONS

1. Place transceiver up-side-down and remove the four rubber feet. Turn transceiver right side up and spread case at bottom and remove.
2. Place part **A** on top of cabinet and drill four (4) 3/16" holes.
3. Use #8 x ½" screws and bolt part **A** to case. (with screw heads inside case.)
4. Use #8 x ½" screws and bolt strap **C** to part **B.**
5. Position part **B** under dash. Drill two (2) 3/16" holes.
6. Use #8 x 1" screws and bolt part **B** under dash.
7. Fasten part **C** to fire wall or a brace under dash using ¼ x 2" screw.
8. Replace cover on transceiver in reverse to step 1.

Now! In less than 15 minutes installation time you can have the MMR-1 installed. Thereafter you only SLIDE in the transceiver for mobil use and SLIDE out for fix station use.





International
CRYSTAL MFG. CO., Inc.
OKLAHOMA CITY, OKLAHOMA

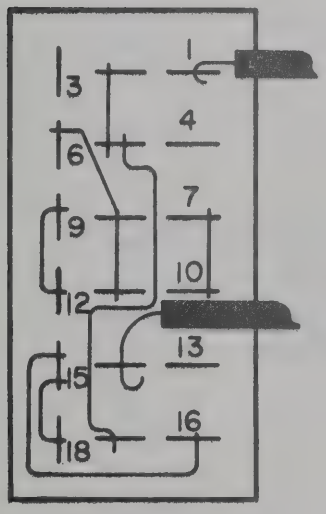
Mobil Mounting Rack

WIRING POWER PLUG FOR MODEL 50

The 3-way power supply may be operated from any one of three different power sources 115 VAC; 6VDC; or 12VDC. Depending upon voltage to be used, connect the jumper wires to the plug as indicated below. A power cord is included with the kit. If it is desired to connect the plug for battery use, two pieces of #12 or larger battery wire, no longer than three feet, should be used between the plug and battery. DO NOT USE SMALL SIZE WIRE OR LONGER LENGTHS WHEN OPERATING FROM BATTERY AS THIS CAUSES EXCESSIVE VOLTAGE LOSS.

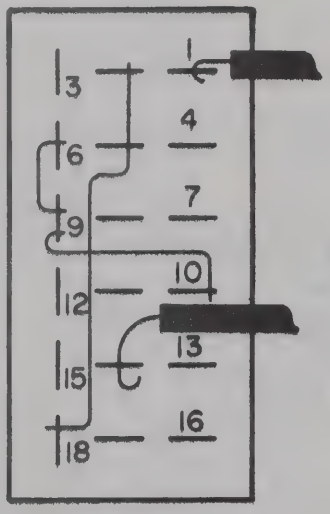
Remove the cover from the power plug by removing the two retainer pins and then separating cover and base. The sketches below are of the connection side of the plug base. Use the #18 buss wire supplied to make jumpers. Where jumpers cross and there is danger of a short, use a length of the insulating sleeving over the wire.

MODEL 50 AND 100



6VDC

MODEL
50 & 100



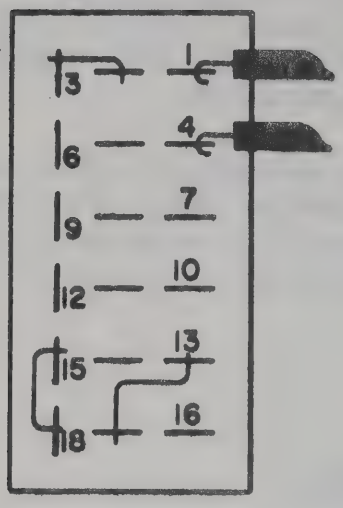
12VDC

6 V Hot to Pin 1
6 V Ground to Pin
14 Jumper Pins

2 to 5	9 to 12
6 to 8	17 to 5
8 to 11	15 to 18
7 to 10	15 to 16

12 V Hot to Pin 1
12 V Ground to Pin
14 Jumper Pins
2 to 5
6 to 9
9 to 10
5 to 18

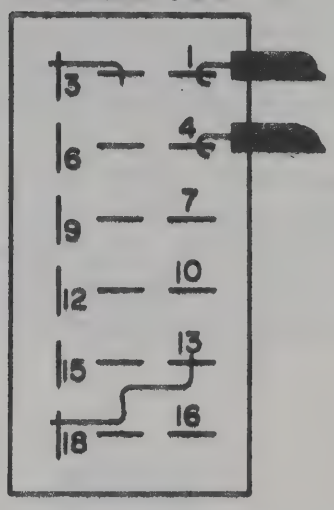
MODEL 50



115 VAC to Pins
1 to 4
Jumper Pins 2 to 3
13 to 17
15 to 18

115 VAC

MODEL 100



115 VAC to Pins
1 to 4
Jumper Pins 2 to 3
13 to 18

Insert the wires, used for connecting to the power source, through the plug cover before connecting to the plug base. A plastic strain relief is provided for placing around the wires where they go through the cover clamp. Tighten the cover clamp screws to hold the wires in place.

CRYSTALS FOR EXECUTIVE MODELS 50 & 100 CITIZEN BANDERS

		TRANSMITTER		RECEIVER (Type "R" Miniature)	
Channel Number	Channel Frequency	Stock Number	Crystal Frequency	Stock Number	Crystal Frequency
1	26.965 mc	900-101	13482.50 kc	900-179	16965.00 kc
2	26.975 mc	900-102	13487.50 kc	900-180	16975.00 kc
3	26.985 mc	900-103	13492.50 kc	900-181	16985.00 kc
4	27.005 mc	900-104	13502.50 kc	900-182	17005.00 kc
5	27.015 mc	900-105	13507.50 kc	900-183	17015.00 kc
6	27.025 mc	900-106	13512.50 kc	900-184	17025.00 kc
7	27.035 mc	900-107	13517.50 kc	900-185	17035.00 kc
8	27.055 mc	900-108	13527.50 kc	900-186	17055.00 kc
9	27.065 mc	900-109	13532.50 kc	900-187	17065.00 kc
10	27.075 mc	900-110	13537.50 kc	900-188	17075.00 kc
11	27.085 mc	900-111	13542.50 kc	900-189	17085.00 kc
12	27.105 mc	900-112	13552.50 kc	900-190	17105.00 kc
13	27.115 mc	900-113	13557.50 kc	900-191	17115.00 kc
14	27.125 mc	900-114	13562.50 kc	900-192	17125.00 kc
15	27.135 mc	900-115	13567.50 kc	900-193	17135.00 kc
16	27.155 mc	900-116	13577.50 kc	900-194	17155.00 kc
17	27.165 mc	900-117	13582.50 kc	900-195	17165.00 kc
18	27.175 mc	900-118	13587.50 kc	900-196	17175.00 kc
19	27.185 mc	900-119	13592.50 kc	900-197	17185.00 kc
20	27.205 mc	900-120	13602.50 kc	900-198	17205.00 kc
21	27.215 mc	900-121	13607.50 kc	900-199	17215.00 kc
22	27.225 mc	900-122	13612.50 kc	900-200	17225.00 kc
23	27.255 mc	900-123	13627.50 kc	900-201	17255.00 kc

SECTION V

SERVICE AND MAINTENANCE

GENERAL

As is the case with all types of electronic equipment, the EXECUTIVE should be checked periodically by a qualified technician to ensure optimum performance at all times and to correct any condition which might later result in equipment failure due to improper adjustment, tube aging or component failure. Since the EXECUTIVE Series receiver differs somewhat in its design from conventional Citizen Band radio sets, no attempt should be made to service this equipment until the technician has become completely familiar with the basic circuitry and has a thorough understanding of the characteristics of dual conversion equipment.

In general, maintenance can be simplified by seeking a definite symptom of a fault and establishing, by reference to the block and schematic diagrams, a condition or series of conditions which might cause the symptom. This will usually help to localize the source of trouble and eliminate those sections of the equipment which are operating properly.

Many technicians tend to overlook the very simple and more obvious sources of trouble in their service work. This may be brought about by a nontechnical operator's description of a particular fault. For example, a Citizen Band operators complaint of intermittent operation may immediately suggest relay trouble or any number of things to a technician. Yet, upon checking further, the trouble may actually be caused by a defective antenna connector or a loose microphone plug or some other condition completely external to the set. For this reason, always quickly check the entire installation for potential trouble before actually removing the set for maintenance work.

DISASSEMBLY OF THE CABINET

The front and rear panels of the unit are bolted to the chassis, so removal of the cabinet consists of removing the top and sides, which are one complete unit. To remove, turn the unit up-side down and remove four, (4) sheet metal screws which are located inside the four rubber feet. These feet will be removed at the same time. Then turn the unit up right and carefully pull the cabinet sides at the bottom of the unit slightly out and lift the cabinet off.

This will leave the bottom plate still secured to the bottom of the chassis. It is not necessary to remove this plate to service tubes or vibrator. To remove this plate, turn the unit up-side-down and remove the two screws which still remain in the bottom plate, and lift it off.

To re-assemble, simply reverse the procedure outlined above.

TEST EQUIPMENT

A properly equipped Citizen Band service shop will probably have most of the basic test equipment for servicing the INTERNATIONAL EQUIPMENT. Because of the much closer frequency tolerances used on Citizen Band radio equipment, greater precision is required of all alignment generators and frequency measuring equipment. A good stable HF signal generator will be most helpful when alignment of the receiver is necessary. Hewlett-Packard type 606-A signal generator is a good example of the type and quality of instrument which has the inherent stability and accuracy that is desirable for servicing Citizen Band radio equipment. An accurately calibrated attenuator with an auxiliary pad to reduce the generator output to 0.25 microvolts or less is very desirable for absolute receiver sensitivity measurements.

Another invaluable instrument is an RF wattmeter such as the Bird Model 611. This unit with the low power 15 watt element will be most useful for accurately checking transmitter output. The instrument is small and rugged enough for in the field checks on Executives to determine transmitter performance.

For receiver audio recovery measurements, the Heath Model AV-3 Audio Vacuum Tube Voltmeter will provide the necessary accuracy required in this test.

For frequency measurement and modulation percentage checks, the INTERNATIONAL Model C-12B Frequency meter is highly recommended. This versatile instrument specifically designed for use on the Citizen Band Channels, allows the technician to make accurate frequency and modulation checks with the minimum of set up time. The instrument can also be used as an accurate frequency standard for calibration of other equipment on Citizen Band channels.

An adequate source of well filtered low-voltage DC which can be varied over a minimum range of 5 to 15 volts with ample current capacity for good regulation is extremely desirable for service work. Although several automobile batteries can be used with taps at each cell to provide a crude range of adjustment, the upkeep and long range maintenance cost will invariably prove to be more costly than a good battery eliminator type of DC supply. One unit of this type is the Heath Model BE-5. Regulation and filtering are adequate for use directly without the need for batteries.

NOTE

Detailed information and prices on the instruments mentioned above may be obtained by contacting the appropriate manufacturer at the address listed below:
Hewlett-Packard Co., 275 Page Mill Rd., Palo Alto, Calif.
Bird Electronic Corp., 1800 E. 38th St., Cleveland 14, Ohio
International Crystal Manufacturing Co., Inc., 18 N. Lee, Oklahoma City 2, Oklahoma
Heath Company, Benton Harbor, Michigan

PREVENTIVE MAINTENANCE

Wherever possible, a routine program of preventive maintenance should be set up on all INTERNATIONAL Executive radio installations in order to ensure maximum equipment utilization with the least number of interruptions for service work. The following list has been prepared as a guide to indicate items which should be included in a preventive maintenance program. Unusual environmental or installation conditions may make it necessary to expand or alter this list to meet individual requirements in the field.

GENERAL

Check all plugs, connectors, tubes, vibrators and fasteners for proper seating. Where equipment is subjected to extremely dusty conditions, occasionally remove the set from its case and dust with a clean, dry brush or with a clean, DRY source of compressed air. Clean the relay contacts only by drawing a small strip of ordinary bond letter paper between the contacts while holding gentle pressure on the relay armature. Do not use a file, sandpaper or any abrassive on relay contacts. The contacts are gold-plated and need only occasional cleaning to remove dust or foreign material. Vacuum or brush out any dust in the case before reinstalling the set.

MOBILE INSTALLATIONS

Check the battery connections. These must be clean and tight at all times. Check the battery at frequent intervals for condition and electrolyte level. Add water, as required, to keep the electrolyte at the proper level.

Inspect the power cable for evidence of physical damage. Check the microphone plug, cable and hanger bracket. Check all plugs and connectors for proper seating and security. Inspect the antenna system carefully. Remove the antenna plug from the set and check for continuity between the center contact of the plug and the actual antenna rod with a low range ohmmeter. Straighten or replace any bent or damaged antenna rods.

Check the voltage regulator for proper operation with the engine running. Adjust the regulator, if necessary, to prevent a voltage in excess of 7.5 volts on 6 volt systems or 14.5 volts on 12 volt systems when the generator is operating at its maximum output.

Inspect the distributor and spark plug wiring. Be sure all terminals are clean, bright and fit securely.

BASE STATION INSTALLATIONS

Check the primary line voltage to make certain it is within its normal limits. If the line voltage is subject to very large fluctuations, install a constant voltage transformer of appropriate capacity.

Inspect the microphone plug, cable and hanger bracket for evidence of excessive wear or damage. Check the antenna system, including the mast or tower, guy wires and coaxial cable. Be sure to inspect the ground wire for the mast or tower. All connections at the tower and ground rod should be clean and tight.

MINIMUM PERFORMANCE

The following routine measurements should be made at periodic intervals. If within the range indicated below, the set can be considered in good operating condition.

1. Check the receiver as follows with no signal input. This can be measured with a VTVM and audio output meter. The Volume control should be wide open, Squelch control OFF, Receive Selector in TUNE position and Tuning Dial set at Channel 9. The AVC voltage at terminal #23 on the IF unit should be from -1.3 to -1.7 and Audio Output across speaker terminals from .3 to .7 VAC. Typical meter readings with a 1 uv 400cps 30% modulated signal are -1.3 to -1.7 volts AVC and 1.8 volts AC or better on the audio output meter. (Early Model 50 production will have about 1.0 volt higher AVC with 1 microvolt.)

2. Check the receiver frequency calibration using the C-12B as a signal source on Channels 1, 9 and 22. If the Tuning dial pointer falls within 1/16th of an inch of the Channel numbers marked on the panel, the calibration is satisfactory.

3. Check the transmitter power output with a RF wattmeter. Rated output at standard input voltages of 6.8, 13.6 and 115 volts should be measured. (Normal 2 to 2.5 watts.)

4. If a reflected power meter is available, check the reflected power when transmitting. The reflected power should be almost negligible if the antenna, coax and transmitter are properly matched.

5. Check transmitter output frequency. Frequency should be .005% or better.

TROUBLE LOCALIZATION

To correct any trouble which may occur in the equipment, first try to isolate the section of the set which causes the trouble. In many instances a good visual inspection of the set will clearly indicate where the defective component is located. Reference to the block diagram of circuit functions and the schematic diagrams on the various sections of the receiver, transmitter and power supply, together with the following list of typical symptoms with probable sources of faults will be helpful in servicing the equipment.

When tubes are indicated as being the cause of the trouble, substitute a new tube of the same type for the one suspected of failure. If no improvement is noted, the original may be reinstalled. It should be noted that where tubes are referred to as trouble possibilities, the circuit components immediately associated with that particular tube may also be the source of trouble.

In trouble shooting the equipment, first check the power supply on 6 and 12 volts DC and 115 volts AC. If trouble is not in the power supply, all further checks can be made on 115 volts AC.

Connect a 115 volt power cord to the unit and remove the antenna and connect a dummy load. The dummy load can be made by connecting a #47 pilot lamp across a spare antenna plug and plugging this into the antenna jack of the unit.

VOLTAGE AND RESISTANCE CHARTS

The E & R charts gives voltages measured on all tube pins and power pin terminals under both receiving and transmitting conditions. The receiving condition voltages are listed under the column marked "R". The transmitting voltages under column "T". Resistance values are given with power removed and are shown in column marked "Res". The filament voltages are not marked AC or DC, as this will depend on whether or not the unit is being operated on the AC line or on battery input voltage.

All voltage readings are taken with the unit operating from 115 volts AC. Voltages measured when using battery input voltage will differ somewhat from those shown in the chart.

POSSIBLE TROUBLE CHART

POSSIBLE POWER SUPPLY TROUBLES

COMPLAINT	POSSIBLE TROUBLE	REMEDY
No B+(AC or DC)	Fuse, switch, rectifier	Replace defective parts.
No B+(DC)	Vibrator, bad connection on power cable.	Replace vibrator Resolder cable.
B+ low (DC)	Battery low, power cable to long, vibrator.	Chg. battery, shorten cable, replace vibrator.
B+ low (AC or DC)	Short in B+, bad rectifier, defective power transformer.	Remove short, replace rectifier or transformer.

POSSIBLE TRANSMITTER SECTION TROUBLES

No RF output	Defective V8 or V9	Replace tube(s)
	Open L14 or L15	Replace coil(s)
	Defective transmitter crystal	Replace crystal

	Poor relay contacts	Clean contacts
Low RF output	L12, C71 or C72 improperly adjusted-Defective V8 or V9	Re-adjust coil or capacitors-Replace tube(s)

POSSIBLE RECEIVER SECTION TROUBLES

Dead (no sound)	Defective V1, V2, V3, V4, V5 Relay contacts dirty	Replace tube(s) Clean contacts
Low volume	Defective tube as listed above. Receiver requires alignment	Replace defective tube(s)-Align if required.

MODEL 50

Power Pin No.	Voltage (± 10%)		Resistance (± 10%)	Unit
	Receive	Transmit		
1	0	0	oo	Converter
2	0	0	0	"
3	— 2.4	—.4	13 K ohms	"
4	0	0	.1 ohms	"
5	6.3 VAC	6.3 VAC	.1 ohms	"
6	+ 255	— 1.4	30 K ohms	"
7	—.7	— 1.4	1.1 megohms	"
8	0	+.5	60 ohms	"
9	0	0	0	"
10	0	0	0	I.F.
11	0	0	1.4 megohms	"
12	+ 1.6 to + 110*	+ 1.3	18 K ohms	"
13	+ 1.1	— 1.3	oo	"
14	+ 255	— 1.4	30 K ohms	"
15	+ 255	— 1.4	30 K ohms	"
16	+ 255	— 1.4	30 K ohms	"
17	+ 255	— 1.4	215 K ohms	"
18	Not Used	—	——	"
19	Not Used	—	——	"
20	—.5	—.24	65 K ohms	"
21	0	0	0	"
22	6.3 VAC	6.3 VAC	0	"
23	—.7	— 1.4	1.0 megohms	"
24	1.25 VAC	0	0	"
25	.06 VAC	0	oo	"
26	0	—.6	5.6 megohms	Audio
27	+ 1.75	+ 1.7	9 K ohms	"
28	0	0	300 K ohms	"
29	+ 1.6 to + 110*	+ 1.2	16.5 K ohms	"
30	0	0	26 ohms	"
31	0	0	0	"
32	+ 15	+ 15	400 ohms	"
33	+ 255	+ 250	30 K ohms	"
34	+ 250	+ 240	30 K ohms	"
35	+ 255	+ 250	30 K ohms	"
36	0	0	0	"
37	6.3 VAC	6.3 VAC	0	"
38	+ 15	0	215 K ohms	"

*Squelch off to full on.

RECEIVER ALIGNMENT

Prior to alignment, the Executive should be turned on and allowed to reach normal operation temperature. This will require approximately 15 minutes. Set the Executive operating controls as follows:

VOLUME to ON position

RECEIVE SELECTOR to TUNE position

TUNING DIAL to CHANNEL 9

SQUELCH to OFF - Fully counterclockwise until switch clicks

NOTE - Disconnect antenna and connect a dummy load to antenna jack. Dummy load may be fabricated from a #47 pilot lamp and a male coaxial connector.

Alignment of the Executive receiver is performed by adjustment of the various stages in the following order: (A) IF alignment, (B) Second Mixer grid circuit, (C) RF & 1st converter circuits.

(A) IF Alignment, 455KC

1. Set signal generator to 455KC and connect its output through a 500 mmfd capacitor to terminal #24 on the IF unit printed circuit board.

2. Set up VTVM for negative voltage measurement on a scale that will accurately indicate from 2 to 4 volts DC. Connect VTVM test probe to AVC terminals #23 on the IF unit printed circuit board.

3. Adjust top and bottom tuning slugs in IF transformers T-1 and T-2 for maximum AVC voltage as indicated on the VTVM.

(B) Second Mixer grid circuit alignment

1. The grid circuit of the second mixer, V3A, is tuned to 10 MC. Alignment of this circuit must be done with a signal source of known accuracy. If the accuracy of the signal generator is questionable, it may be calibrated as follows:

   a. Using a short wave communications receiver, tune in the National Bureau of Standards Station WWV at 10 MC.

   b. Zero beat the signal generator against the 10MC WWV signal being received by the communications receiver.

2. After the signal generator has been calibrated at 10 MC, connect its output through a 500 mmfd capacitor to terminal #24 on the IF unit printed circuit board.

3. Adjust the tuning slug in coil L8 for maximum AVC voltage as indicated by the VTVM. As the AVC voltage increases, decrease the generator output to a useable level.

4. Readjust the tuning slugs in the IF transformers T-1 and T-2 for maximum AVC voltage as indicated by the VTVM. Disconnect the signal generator from the IF unit.

(C) RF & 1st Converter circuit alignment

1. The RF & 1st converter circuits must be aligned with a signal generator of known accuracy. If the calibration of the generator is questionable, it may be set on the proper channel frequency by the following method.

   a. Since the first alignment step requires a signal source on Channel 9, set the main tuning dial of the Executive to that position.

   b. Set RECEIVE SELECTOR switch to the TUNE position.

   c. Set VOLUME control to about half open.

   d. Remove dummy load from Executive antenna jack.

   e. Set up the INTERNATIONAL C-12B Frequency Meter for operation on Channel 9, and insert the telescoping antenna into the frequency meter RF jack. Set function switch to the RF position.

   f. Move the frequency meter close to the Executive and depress meter PWR switch to the ON position.

   g. Rotate Executive tuning dial for maximum AVC voltage as indicated by the VTVM.

h. Connect the output of signal generator to Executive antenna jack. Turn generator on and set frequency control dial to channel 9 frequency. Slowly adjust generator frequency until VTVM indicates maximum AVC voltage. Reduce generator output until the AVC voltage is equal to that produced by the C-12B signal.

i. Depress C-12B PWR switch to ON. An audio beat note will be heard in the receiver speaker. Carefully adjust generator frequency tuning for zero beat with the signal from the C12B. This calibrates the signal generator on Channel 9. The above described procedure may be used to calibrate the generator on any Citizen Band Channel desired.

2. Connect test leads of an audio output meter to voice coil terminals of the receiver speaker. Set meter voltage range switch to a low voltage scale that will provide an accurate reading of 2 to 5 volts AC.

3. With generator and receiver tuning set on Channel 9, set signal generator function switch to MCW position at 400 cps. Set modulation level to 30%. Turn receiver VOLUME control fully clockwise and set generator RF output level to produce 2 volts of audio on output meter.

4. Adjust tuning slugs in coils L2, L4 and L7 for maximum audio voltage on output meter. Reduce generator RF output level to maintain 2 volts of audio on output meter. Set generator and receiver tuning to Channel 22. Adjust tuning slug in coil L1 for maximum audio voltage on output meter.

5. Calibration of the receiver tuning dial must be done with a signal generator of known accuracy. If generator accuracy is questionable, it may be calibrated as previously discussed under 1., paragraphs e. through i.

6. Set generator on Channel 9 and rotate Executive tuning dial for maximum audio recovery as indicated on output meter. This dial setting should fall within ± 1/16th of an inch of the panel marking for Channel 9. If the pointer setting is not within this tolerance, adjustment of the 1st converter oscillator will be necessary. Before making any adjustment to the oscillator, it will be necessary to check the receiver tuning spread.

7. Set generator on Channel 1 frequency. Rotate tuning dial towards Channel 1 panel marking. Tune receiver for maximum audio recovery as indicated by the output meter. Note tuning dial pointer position with relation to Channel 1 panel marking.

8. Set generator to Channel 22 frequency. Repeat procedure of Step 7. Note tuning dial pointer position with relation to Channel 22 panel marking. If all three check points are off calibration about the same amount in the same direction, the tuning spread is correct and only the tuning slug in coil L3 needs adjusting at the Channel 9 dial setting to bring the unit back into calibration tolerance.

9. If calibration checks OK at Channel 9 and is off at either the Channel 1 or Channel 22 check points, the tuning spread is incorrect and capacitor C13 must be adjusted.

10. In the first instance described under 8, set generator at Channel 9 frequency and tuning dial pointer at Channel 9 panel mark. Using a small insulated hex tuning tool, slowly adjust the tuning slug in oscillator coil L3 for maximum audio recovery as indicated by the output meter. Check calibration at Channel 1 and Channel 22.

11. In the second instance covered under 9, the following adjustments should be made. Set generator to Channel 9 frequency. Set receiver tuning dial pointer to Channel 9 panel mark. Using an insulated tuning tool, turn the rotor of capacitor C13 in a clockwise direction until it is fully closed. Rotate rotor of C13 in a counterclockwise direction for 1 1/2 turns. Adjust tuning slug in oscillator coil L3 for maximum audio recovery as indicated by the output meter. Check calibration at Channel 1 and Channel 22. If calibration is still not within tolerance, alternately adjust capacitor C13 and tuning slug in L3 until calibration falls within the tolerance limits.

12. In instances where the unit has receive crystals installed in the RECEIVE SELECTOR switch assembly crystal sockets, the crystals can be trimmed exactly to the proper channel frequency by their associated capacitors C16 and C17 as follows:

    a. Where the receiver crystal controlled channels are to be used for communications with only the one station, such as a base station, "netting" of the receiver using the base station as signal source on the proper channel will produce optimum results.

    b. In instances such as covered by a. above, attach an antenna to the Executive antenna jack, set RECEIVE SELECTOR to the proper position. Using the base station signal, adjust the crystal trimmer for maximum AVC voltage as indicated by the VTVM. If there are two crystal control positions being used, repeat the above described adjustment for the second crystal controlled position.

c. Instances where the crystal controlled channels are to be used in communicating with more than one station, set the signal generator up on the proper channel. With the generator in the MCW position, and RF output set at 1 uv, adjust the trimmer capacitor associated with that channel for maximum audio recovery as indicated by the output meter. If both crystal control channels are to be used, repeat the above described adjustment for the second crystal controlled position.

13. After alignment has been completed, set generator and receiver tuning to Channel 9. Turn receiver VOLUME control fully on. Adjust generator RF output until audio output meter reads 2 volts. Note generator RF output level. It should be 1 uv or less. Turn generator to standby position and note noise level on the audio output meter. This reading will depend upon noise level of the test location, but in the average test bench location, where florescent illumination is used, the reading will be approximately .5 volts and AVC voltage will be about -1.5 volts.

14. Turn SQUELCH CONTROL fully clockwise. Slowly rotate SQUELCH CONTROL in a counterclockwise direction until the receiver background noise is just quieted. Turn signal generator to MCW position and note audio level on output meter. This should be approximately 1.5 volts or better. This completes receiver alignment.

TRANSMITTER ALIGNMENT

The Executive series transmitter alignment can be done with an RF wattmeter, but for a complete check of overall performance the following test equipment will be required.

a. RF wattmeter - Bird 611 or equivalent.
b. Frequency meter with an accuracy of at least .0025% - INTERNATIONAL C-12B or equivalent.

2. Connect an RF wattmeter to the antenna jack on the back of the Executive.

3. Turn the set on and allow 15 minutes for the unit to reach normal operating temperature.

4. When several different crystals will be used in the transmitter, select one whose frequency is approximately half-way in between the others.

5. Key the transmitter by depressing the microphone press-to-talk switch.

6. Adjust final amplifier tuning capacitor C71 and loading capacitor C72 alternately for maximum output as indicated by the wattmeter.

7. With the volume control set at the one-half open position, and talking within normal distance from the microphone, adjust oscillator plate coil for maximum upward deflection as indicated on the wattmeter.

8. Depress the press-to-talk switch several times and note whether or not the oscillator starts immediately each time the switch is depressed.

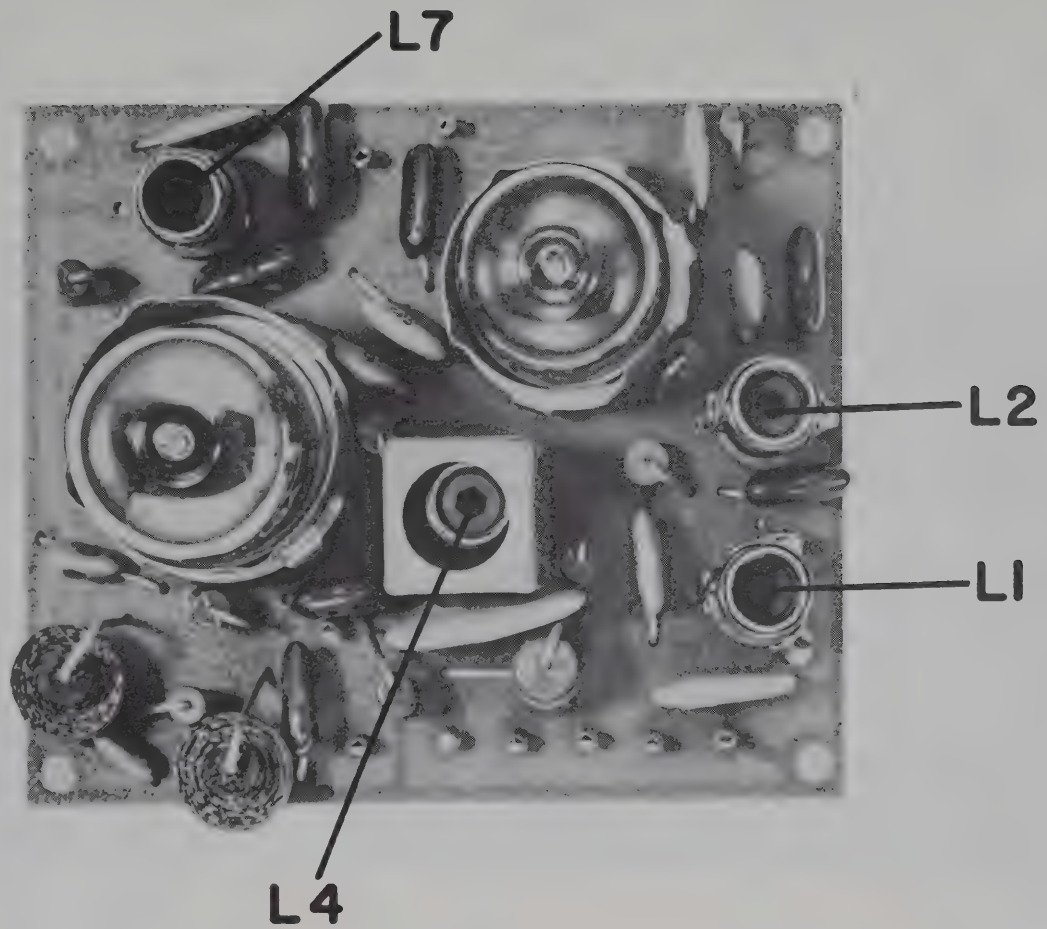
9. The Executive series transmitter has an overall frequency tolerance of .005% or better. UNLESS SUITABLE HIGH-ACCURACY FREQUENCY MEASURING EQUIPMENT IS AVAILABLE, DO NOT ATTEMPT TO ADJUST THE TRANSMITTER FREQUENCY. A small trimmer capacitor, C61, is provided to make minor adjustments in the transmitter frequency.

10. Set TRANSMIT SELECTOR to the Channel previously used for transmitter alignment. Connect C-12B Frequency Meter through the PK-1 pick-up box to the transmitter antenna jack.

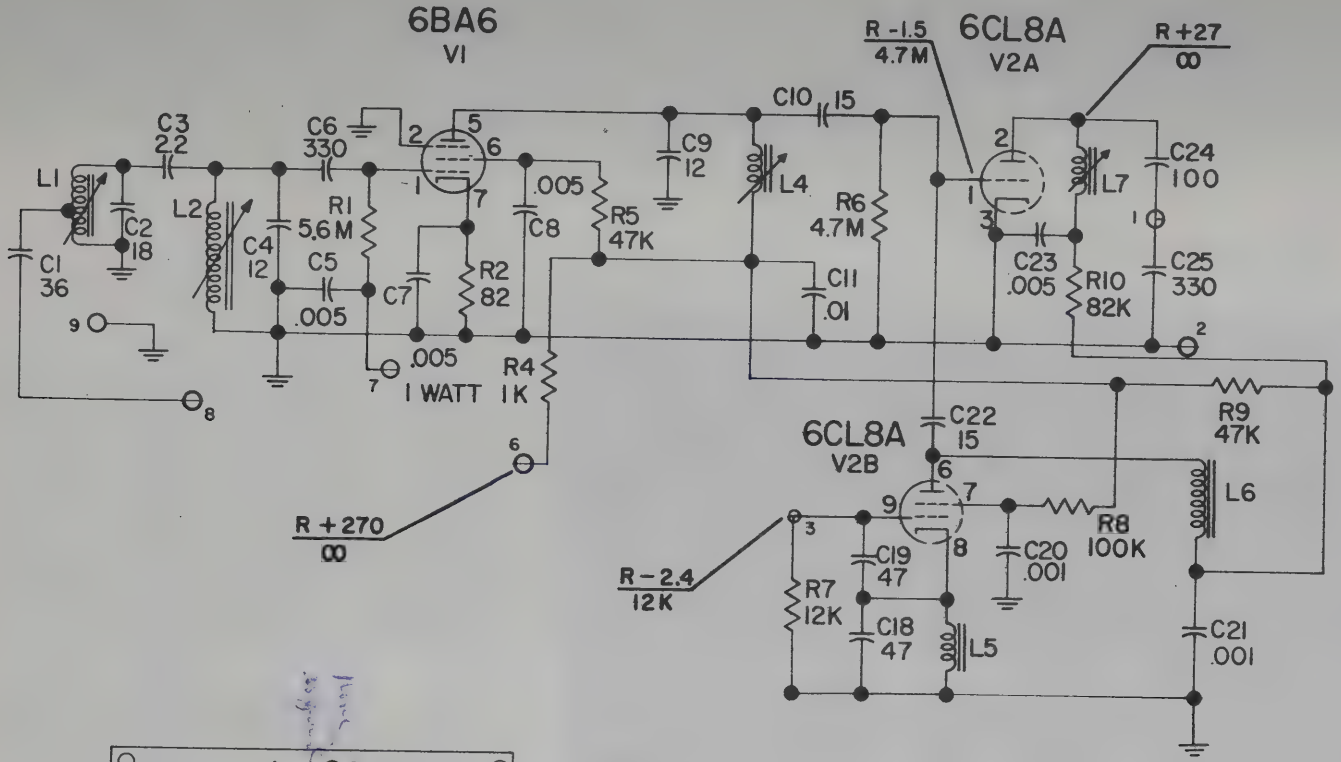
11. Set up Frequency Meter for measurement on the channel to be measured. Depress microphone press-to-talk switch and measure the frequency. If the frequency is out of tolerance, adjust trimmer C61 until the transmitter frequency is within tolerance. If this cannot be accomplished within the tuning range of C61, check the other channels in the set. If they can be brought into tolerance with trimmer C61, the crystal can be considered defective and must be replaced. If they cannot be brought into tolerance, possibly either of capacitors C62 or C63 has changed value.

12. Before replacing either of these components, if possible, the crystals in question should be checked in another Executive transmitter. If they still cannot be brought into tolerance, chances are that the crystals are defective and should be replaced. If they can be brought into tolerance in a like unit, capacitors C62 and C63 should be checked and the defective component replaced.

13. Set up C-12B Frequency Meter for modulation check. Key transmitter and talk into microphone at a normal level with a prolonged AHHHHH. The Executive Transmit indicator lamp should begin to flicker and modulation percentage should be approximately 95%. This completes the transmitter alignment.



CONVERTER UNIT



NOTE:

Voltage / Resistance

T-TRANSMIT

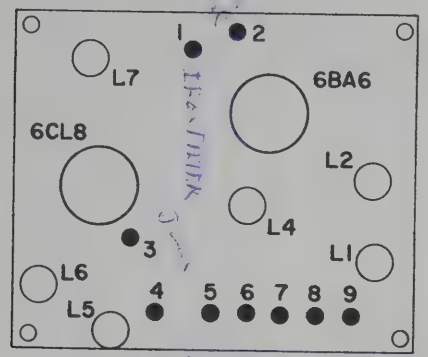
R-RECEIVE

VOLTAGE MEASUREMENTS, NO SIGNAL

115V OPERATION.

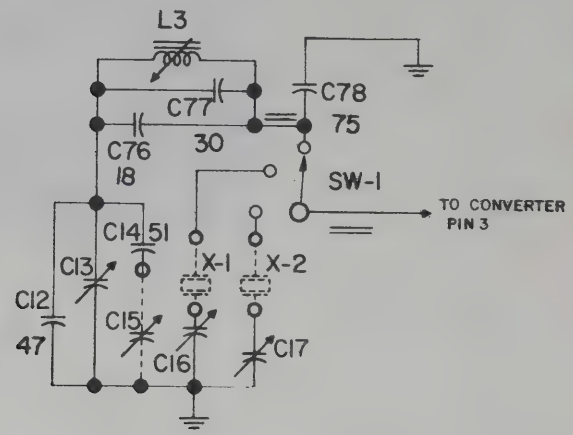
VOLTAGES WILL VARY FROM 6 TO 12 TO 115 VOLT OPERATION.

VOLTAGE MEASUREMENTS MADE WITH VTVM.

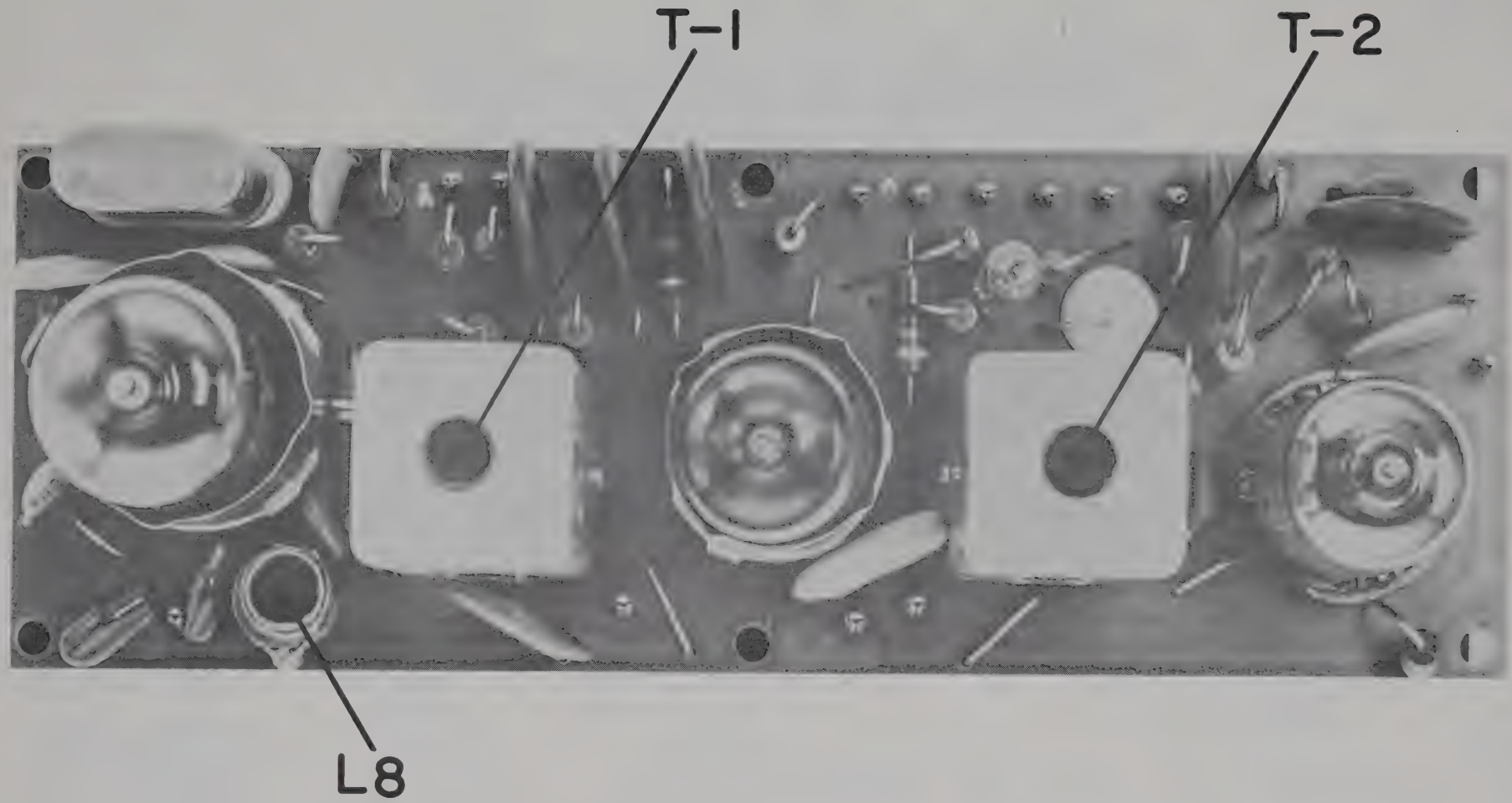


POWER PIN CONNECTIONS

1	10 MC OUT	6	B+
2	GND	7	AVC
3	XTAL SW.	8	ANT.
4	12V. FIL.	9	GND
5	6V. FIL.		

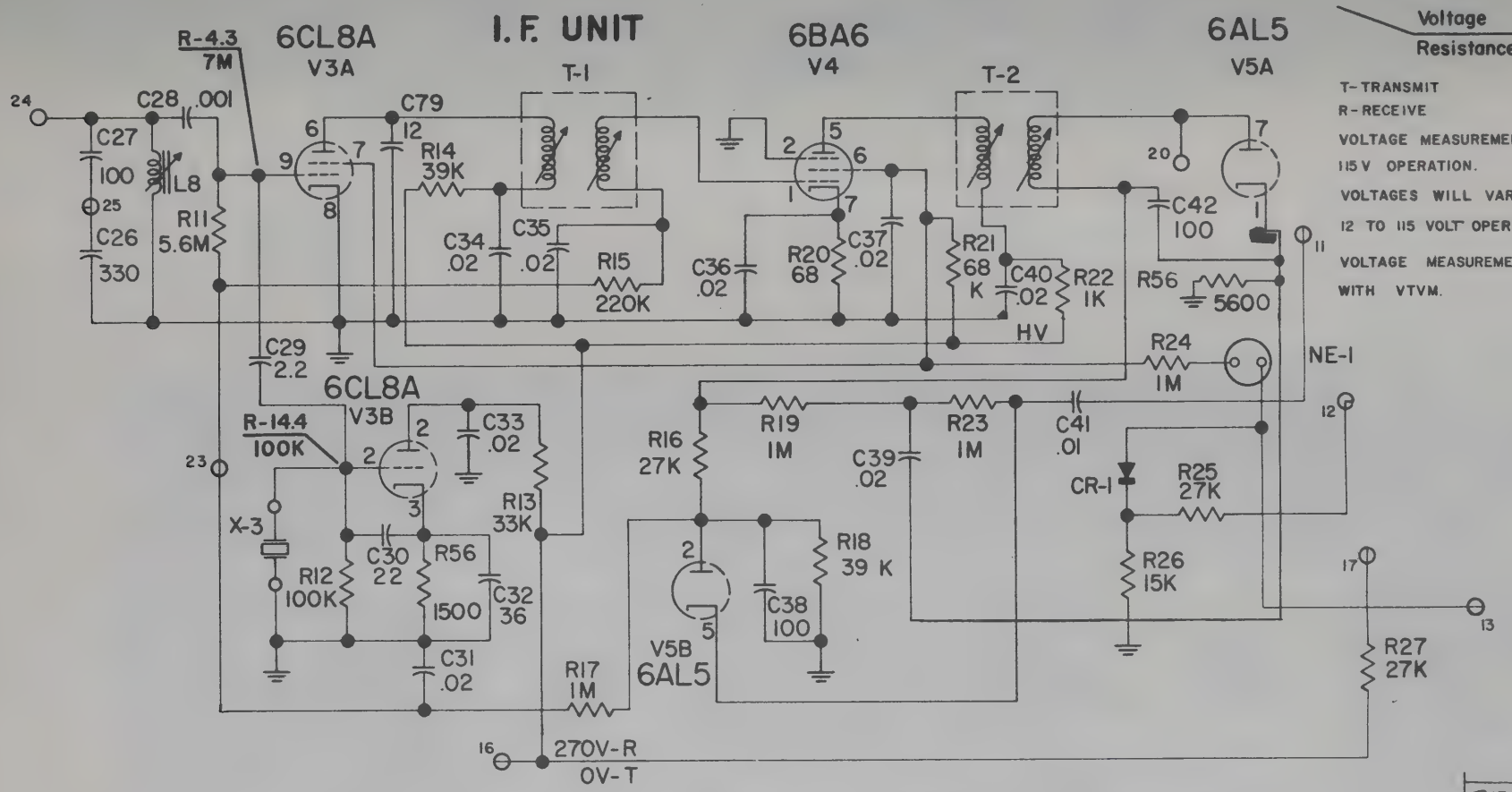


CONVERTER & XTAL SW. ASSM. MODEL 50		
DRAWN BY- [illegible] DATE- 5-10-61	CHECKED BY- DATE- [illegible]	APPROVED BY [illegible]
INTERNATIONAL CRYSTAL MFG. CO., INC. 18 N. LEE, OKLAHOMA CITY, OKLAHOMA		



I.F. UNIT

I.F. UNIT



NOTE:

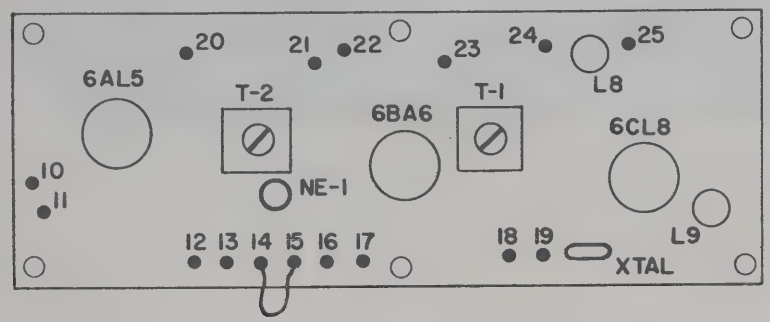
Voltage / Resistance

T- TRANSMIT
R- RECEIVE

VOLTAGE MEASUREMENTS, NO SIGNAL 115 V OPERATION.

VOLTAGES WILL VARY FROM 6 TO 12 TO 115 VOLT OPERATION.

VOLTAGE MEASUREMENTS MADE WITH VTVM.



POWER PIN CONNECTIONS

10	AUDIO OUT GND	18	NOT USED
11	AUDIO OUT	19	NOT USED
12	TO SQUELCH CONTROL	20	455 KC OUT
13	TO SW-3 & AUDIO GRID	21	12V FIL
14	JUMPER TO 15	22	6V FIL
15	JUMPER TO 14	23	AVC
16	B+	24	10MC IN HI
17	TO SQUELCH CONTROL	25	10MC IN LO

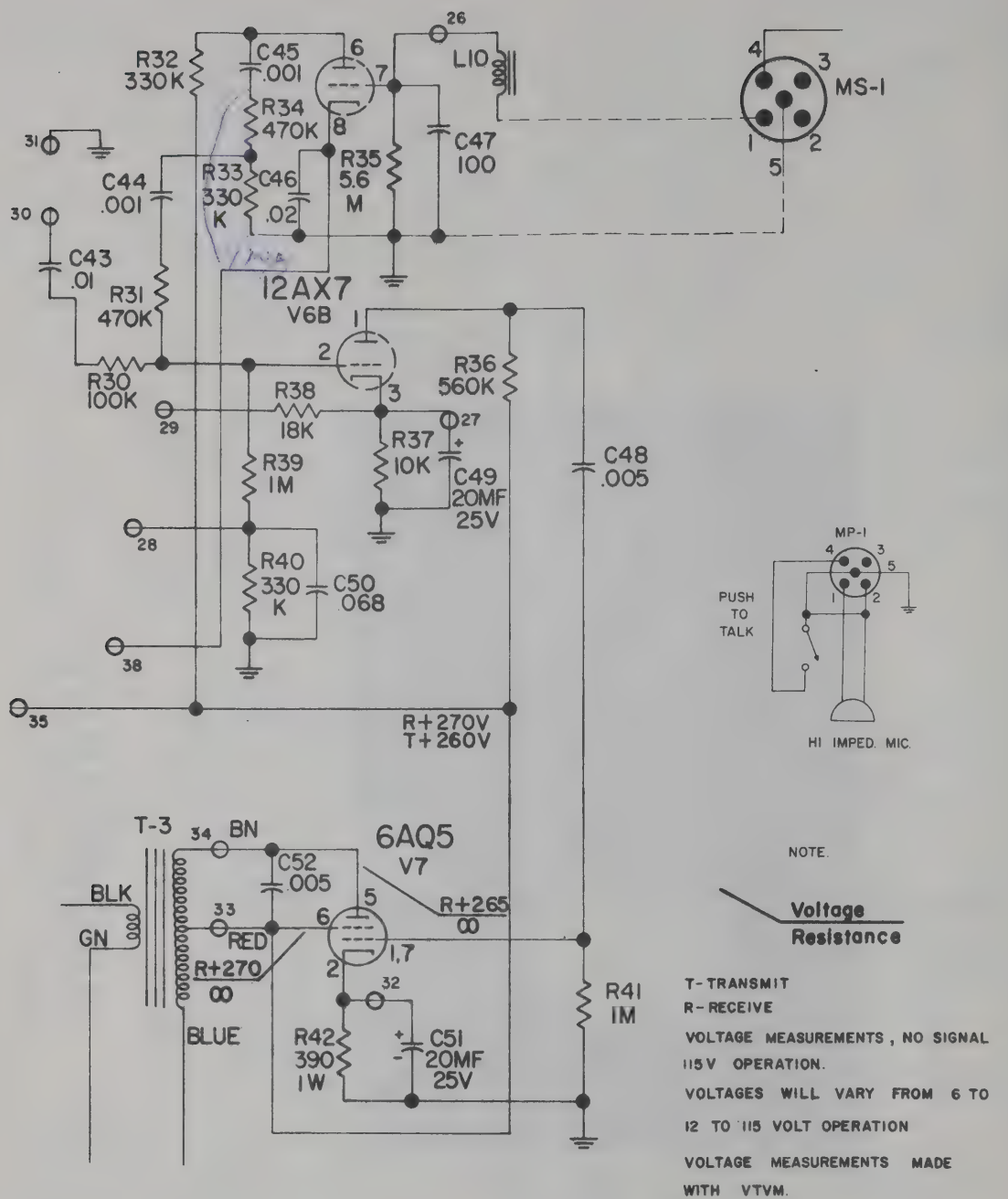
REVISION	DATE
R17 connected to Pin 2 of V5B	10-10-61
C39 connected to Pin 1 of V5A	10-10-61
R16 changed to 39 K	10-10-61
R16 changed to 27K	10-10-61
R56 added	10-10-61
C42 Connected to Pin 1 of V5A	10-10-61
L9 Changed to R56, 1500	6-6-61

I.F. UNIT
MODEL 50

DRAWN BY-	CHECKED BY-	APPROVED BY
DATE- 5-9-61	DATE-	

INTERNATIONAL CRYSTAL MFG. CO., INC.
18 N. LEE, OKLAHOMA CITY, OKLAHOMA

AUDIO UNIT



NOTE.

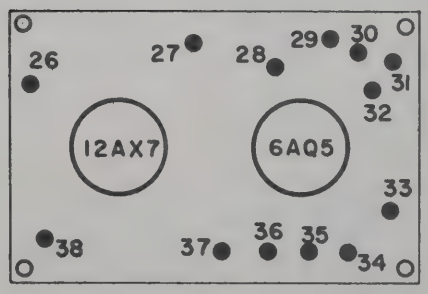
Voltage
Resistance

T-TRANSMIT
R-RECEIVE

VOLTAGE MEASUREMENTS, NO SIGNAL 115V OPERATION.

VOLTAGES WILL VARY FROM 6 TO 12 TO 115 VOLT OPERATION

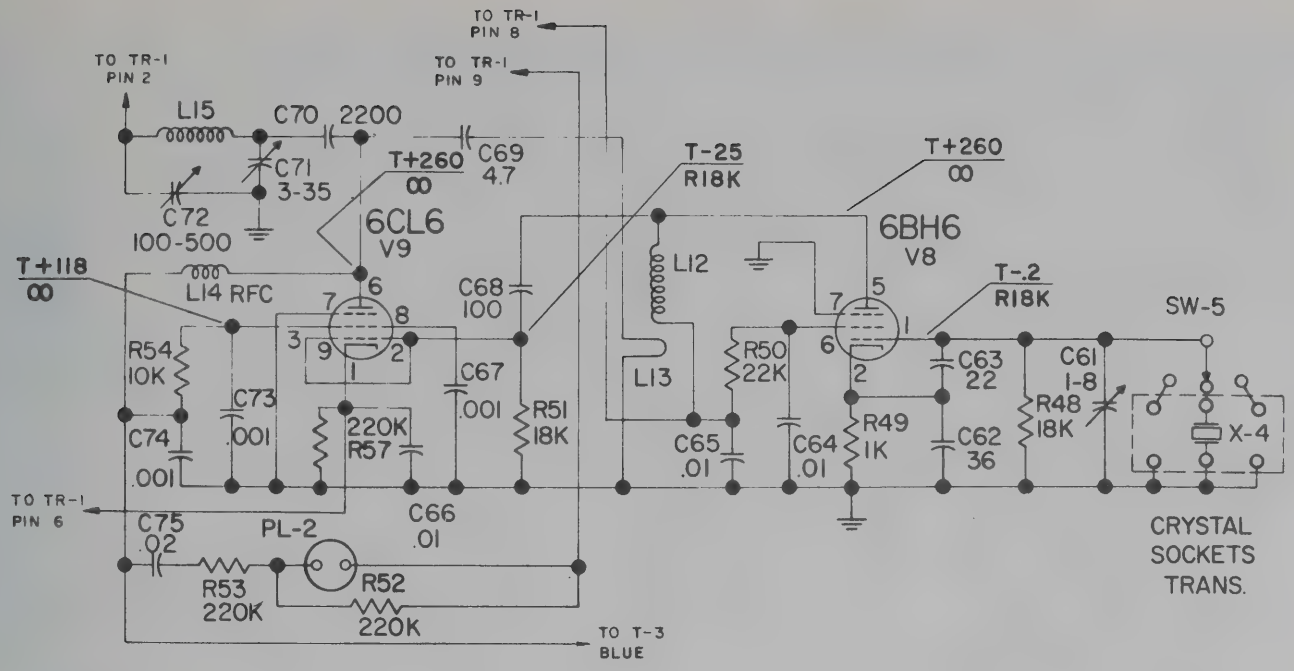
VOLTAGE MEASUREMENTS MADE WITH VTVM.

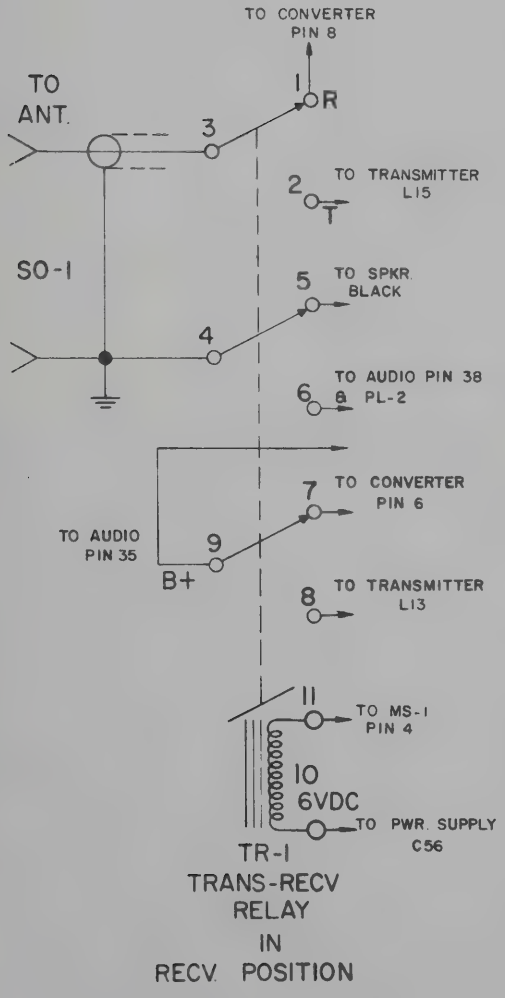


POWER PIN CONNECTIONS

26	MIC. IN	32	TO C51
27	TO C49	33	TO TRANS. B+
28	TO SW-3 & SQ AUDIO GRID	34	TO TRANS. PLATE
		35	B+
29	TO SQ. CONTROL	36	12V FIL.
30	AUDIO IN	37	6V FIL.
31	GND	38	CATHODE TO TR-1 PIN 6

AUDIO UNIT MODEL 50		
DRAWN BY- [illegible] DATE- 5-5-61	CHECKED BY- DATE- WMR	APPROVED BY [illegible]
INTERNATIONAL CRYSTAL MFG. CO., INC. 18 N. LEE, OKLAHOMA CITY, OKLAHOMA		



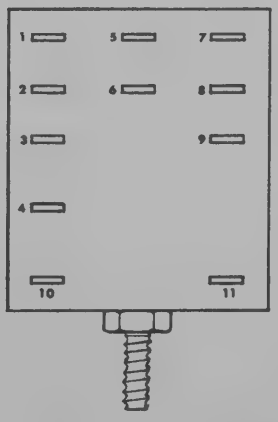


NOTE:

Voltage
Resistance

T-TRANSMIT
R-RECEIVE
VOLTAGE MEASUREMENTS, NO SIGNAL
115 V OPERATION.
VOLTAGES WILL VARY FROM 6 TO 12 TO 115 VOLT OPERATION.
VOLTAGE MEASUREMENTS MADE WITH VTVM.

RELAY TR-1

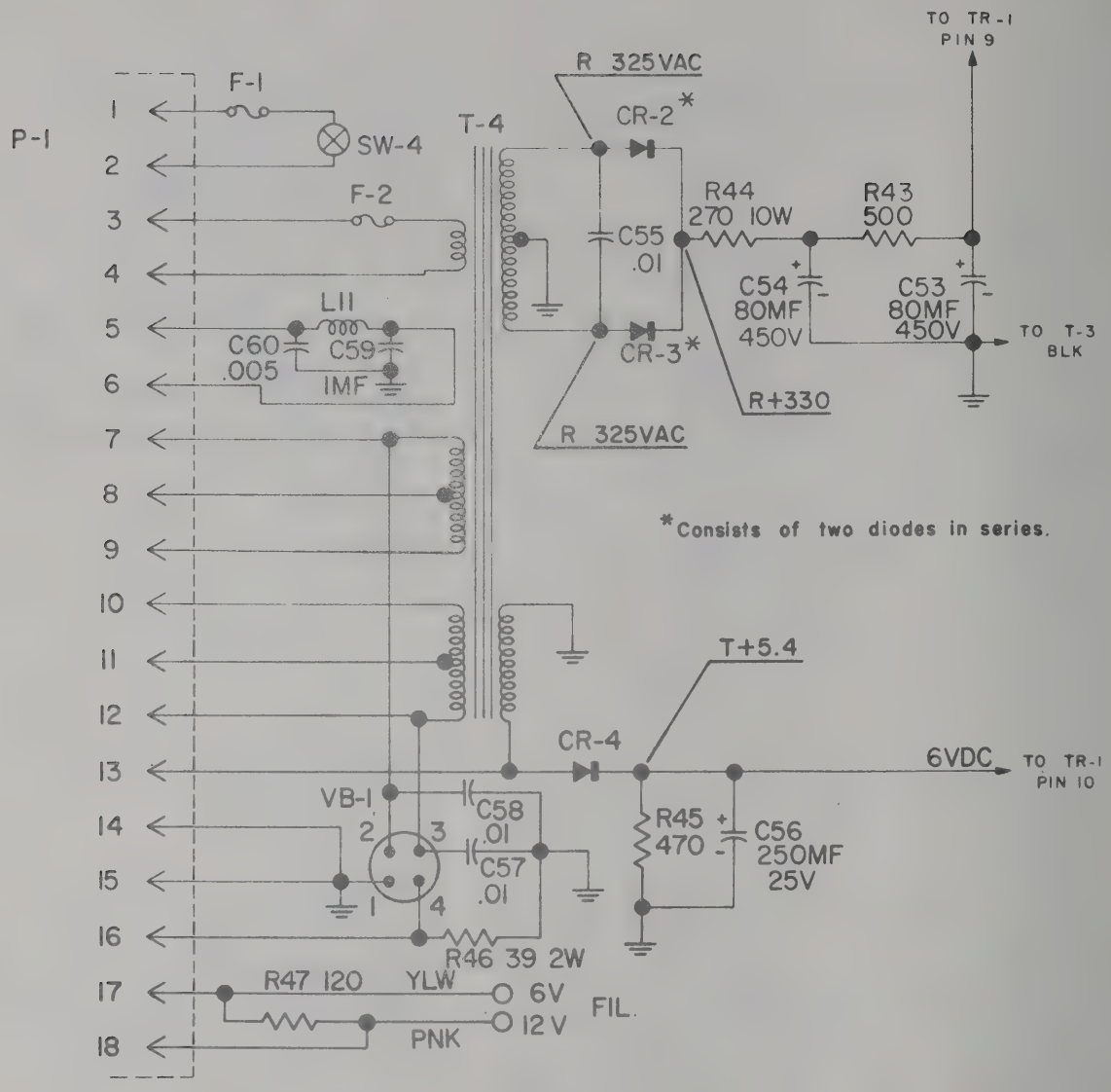


REVISION	DATE
R57, 22K From Pin 1 of V9 to Gnd added	10-10-61

TRANSMITTER MODEL 50

DRAWN BY-	CHECKED BY-	APPROVED BY
DATE- 5-8-61	DATE-	— RDY —

INTERNATIONAL CRYSTAL MFG. CO., INC.
18 N. LEE, OKLAHOMA CITY, OKLAHOMA



115VAC 115VAC TO PINS 1 & 4
JUMPER PINS 2-3, 13-17, 15-18

6VDC 6VDC HOT TO PIN 1
6VDC GND TO PIN 14
JUMPER PINS 2-5, 6-8, 8-11, 7-10
9-12, 17-5, 15-18, 15-16

12VDC 12VDC HOT TO PIN 1
12VDC GND TO PIN 14
JUMPER PINS 2-5, 6-9, 9-10, 5-18

NOTE:

Voltage
Resistance

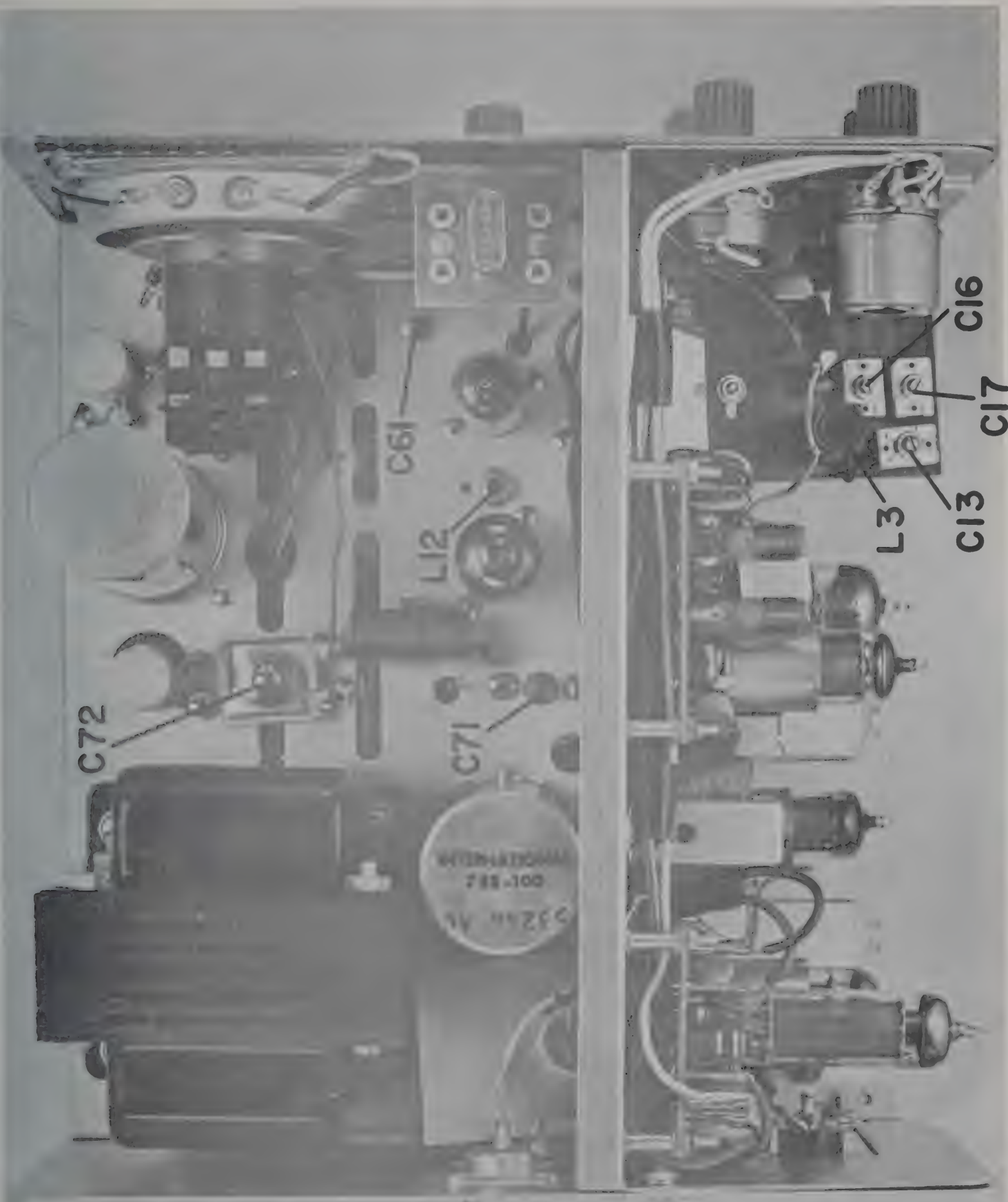
T - TRANSMIT
R - RECEIVE

VOLTAGE MEASUREMENTS, NO SIGNAL 115 V OPERATION.

VOLTAGES WILL VARY FROM 6 TO 12 TO 115 VOLT OPERATION.

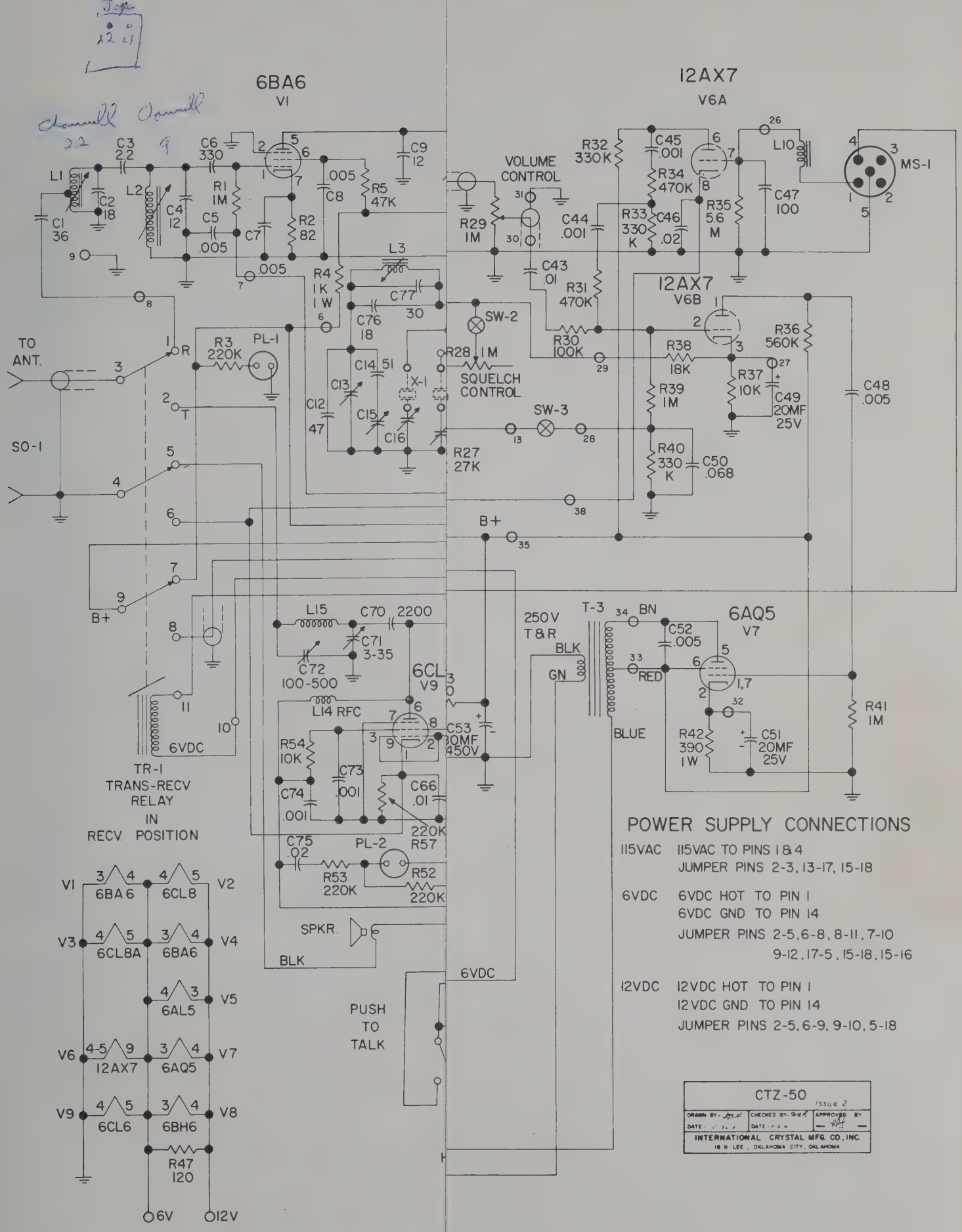
VOLTAGE MEASUREMENTS MADE WITH VTVM.

POWER SUPPLY MODEL 50		
DRAWN BY [illegible] DATE 2-18-64	CHECKED BY- DATE- 2-18-64	APPROVED BY [illegible]
INTERNATIONAL CRYSTAL MFG. CO., INC. 18 N LEE, OKLAHOMA CITY, OKLAHOMA		



TOP VIEW POWER SUPPLY & TRANSMITTER

BOTTOM VIEW POWER SUPPLY & TRANSMITTER



POWER SUPPLY CONNECTIONS

115VAC 115VAC TO PINS 1 & 4
JUMPER PINS 2-3, 13-17, 15-18

6VDC 6VDC HOT TO PIN 1
6VDC GND TO PIN 14
JUMPER PINS 2-5, 6-8, 8-11, 7-10
9-12, 17-5, 15-18, 15-16

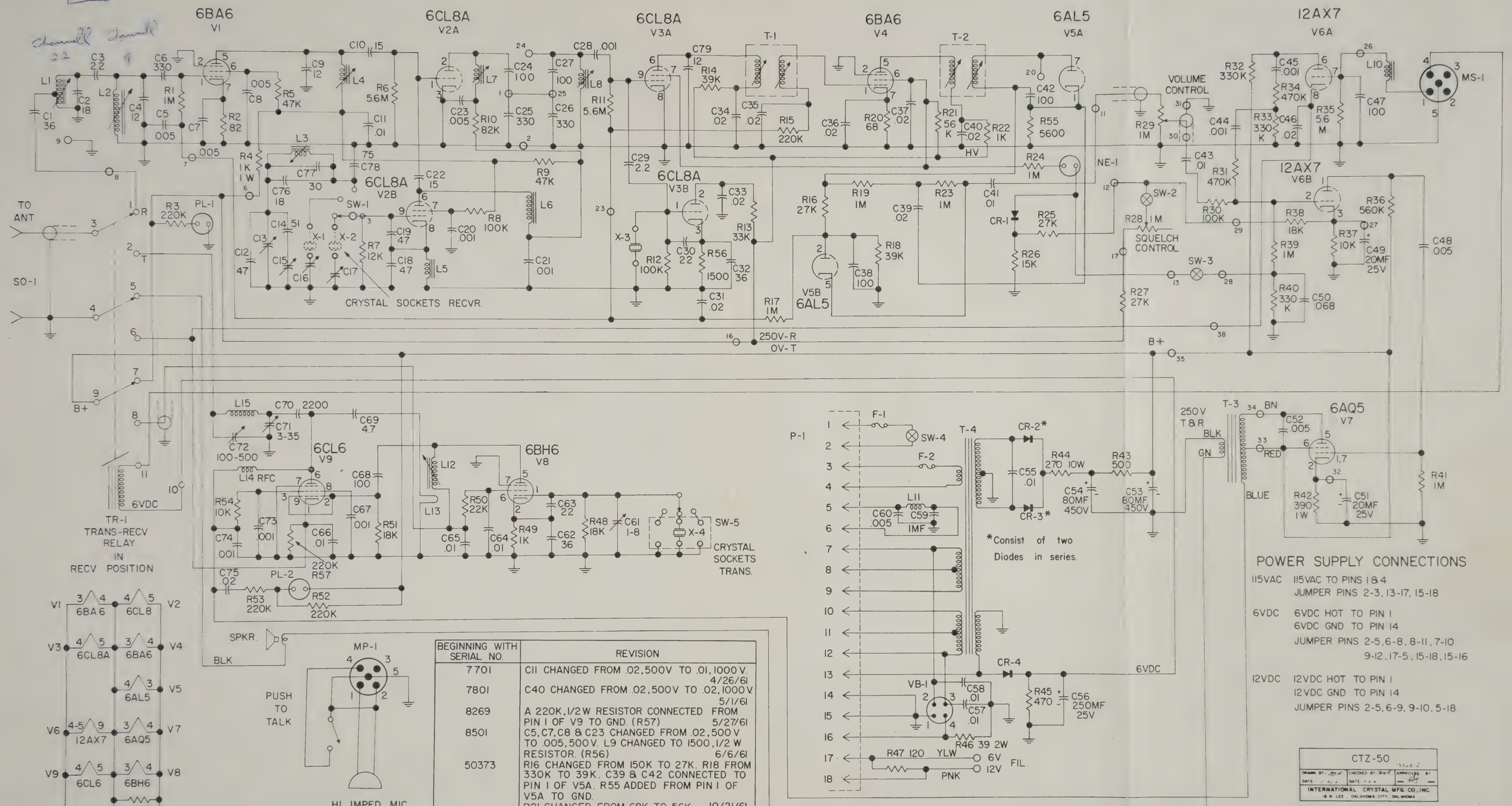
12VDC 12VDC HOT TO PIN 1
12VDC GND TO PIN 14
JUMPER PINS 2-5, 6-9, 9-10, 5-18

CTZ-50 ISSUE 2

DRAWN BY	CHECKED BY	APPROVED BY
DATE	DATE	—

INTERNATIONAL CRYSTAL MFG. CO., INC.
18 N LEE, OKLAHOMA CITY, OKLAHOMA

BOTTOM VIEW POWER SUPPLY & TRANSMITTER



BEGINNING WITH SERIAL NO.	REVISION
7701	C11 CHANGED FROM .02,500V TO .01,1000 V. 4/26/61
7801	C40 CHANGED FROM .02,500V TO .02,1000V 5/1/61
8269	A 220K,1/2W RESISTOR CONNECTED FROM PIN 1 OF V9 TO GND. (R57) 5/27/61
8501	C5,C7,C8 & C23 CHANGED FROM .02,500 V TO .005,500V. L9 CHANGED TO 1500,1/2 W RESISTOR. (R56) 6/6/61
50373	R16 CHANGED FROM 150K TO 27K. R18 FROM 330K TO 39K. C39 & C42 CONNECTED TO PIN 1 OF V5A. R55 ADDED FROM PIN 1 OF V5A TO GND. R21 CHANGED FROM 68K TO 56K. 10/21/61

POWER SUPPLY CONNECTIONS

115VAC 115VAC TO PINS 1 & 4
JUMPER PINS 2-3, 13-17, 15-18

6VDC 6VDC HOT TO PIN 1
6VDC GND TO PIN 14
JUMPER PINS 2-5, 6-8, 8-11, 7-10
9-12, 17-5, 15-18, 15-16

12VDC 12VDC HOT TO PIN 1
12VDC GND TO PIN 14
JUMPER PINS 2-5, 6-9, 9-10, 5-18

NOTE: T - TRANSMIT
R - RECEIVE
VOLTAGE MEASUREMENTS, NO SIGNAL
115V OPERATION.
VOLTAGES WILL VARY FROM 6 TO 12
TO 115 VOLT OPERATION.

CTZ-50 ISSUE 2

INTERNATIONAL CRYSTAL MFG. CO., INC.
18 N. LEE, OKLAHOMA CITY, OKLAHOMA

WARRANTY REGISTRATION

Model_____ Date Purchased_____ Serial No._____

Purchased from_____

Owner's Name_____

Owner's Address_____

City_____ State_____

Owner's Call_____

10-153

WARRANTY

International Crystal Manufacturing Company warrants the parts and tubes in any International Citizen Transceiver to be free from defects in workmanship and material arising from normal usage. Its obligation under this warranty is limited to replacing any such parts or tubes of the receiver which, after regular installation and under normal usage and service, shall be returned within ninety (90) days from the date of original purchase of the set to the authorized dealer from whom the purchase was made and which shall be found to have been thus defective in accordance with the policies established by International Crystal Manufacturing Company.

The obligation of International Crystal Manufacturing Company is limited to making replacement parts available to the purchaser, and does not include either the making or the furnishing of any labor in connection with the installation of such replacement parts nor does it include responsibility for any transportation expense.

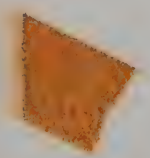
International Crystal Manufacturing Company assumes no liability and shall not be liable in any respect for failure to perform or delay in performing its obligations with respect to the above warranty if such failure or delay results, directly or indirectly, from any preference, priority or allocation order issued by the Government or because of any other act of the Government, or by war, conditions of war, inadequate transportation facilities, conditions of weather, acts or God, strikes, lockouts, Governmental controls, or Internationals reasonable requirements for manufacturing purposes, or any cause beyond its control or occurring without its fault, whether the same kind or not.

CONDITIONS AND EXCLUSIONS

This warranty is expressly in lieu of all other agreements and warranties expressed or implied, and International Crystal does not authorize any person to assume for it the obligations contained in this warranty and neither assumes nor authorized any representative or other person to assume for it any other liability in connection with such International units or parts or tubes thereof.

The warranty herein extends only to the original consumer pruchaser and is not assignable or transferable and shall not apply to any transceiver or parts or tubes thereof which have been repaired or replaced by anyone else other than an authorized International dealer, service contractor or distributor, or which have been subject to alteration, misuse, negligence or accident, or to the parts or tubes of any receiver which have had the serial number or name altered, defaced or removed.

International Crystal Manufacturing Company is under no obligation to extend this warranty to any unit for which an International registration card has not been completed and mailed to the Company within fifteen (15) days after date of purchase.



FEDERAL COMMUNICATIONS COMMISSION
Washington 25, D. C.

87048
April 15, 1960

UNAUTHORIZED PRACTICES IN BUSINESS AND CITIZENS RADIO SERVICES

An increasing number of reports have reached the Commission concerning the practice of some suppliers of Business and Citizens Radio Services equipment to advise their customers that such equipment may be operated by them prior to the issuance of a radio station license by the Commission. In some instances, sellers have "assigned" radio station call signs to purchasers in conjunction with the sale of radio apparatus and, in a few such cases, these call signs have been identical with those authorized to be used by the manufacturer or seller of the equipment.

A radio station license is required for the use or operation of a radio station in the Business and Citizens Radio Services by Section 301 of the Communications Act. With the exception of certain low power equipment described in Part 15 of the Commission's Rules, the operation of any radio transmission apparatus by a person other than the one to whom the Commission has issued a radio station license is illegal and may result in the imposition of severe criminal sanctions (one year in prison or $10,000 fine, or both) or in the institution of other enforcement action by the Commission.

Under Section 310 (b) of the Communications Act, the prior consent of the Commission is required for the transfer or assignment of any radio station license or the rights granted thereunder. One who fails to observe this provision by the purported transfer of his operating authority subjects himself to possible license revocation and such other enforcement action as the Commission may consider warranted by the circumstances. The denomination of such unlawful activities as "equipment demonstrations" does not render them less illicit.

This matter is being brought to the attention of manufacturers, distributors and retail vendors of Business and Citizens Radio Service communication equipment in the belief that they share the Commission's conviction that the orderly development of these dynamic special radio services is hampered by the above-described practices and that one who engages in such practices, in addition to the possibility of having drastic enforcement action instituted against him, may be sacrificing for the benefit of an immediate sale the long range good will of a misadvised customer.

It is requested that the foregoing be brought to the attention of the personnel in all organizations concerned in any way with the sale, maintenance or use of Business or Citizens Radio Stations in order that a prompt cessation of unlicensed operation of radio stations in these services may be brought about.

-FCC-

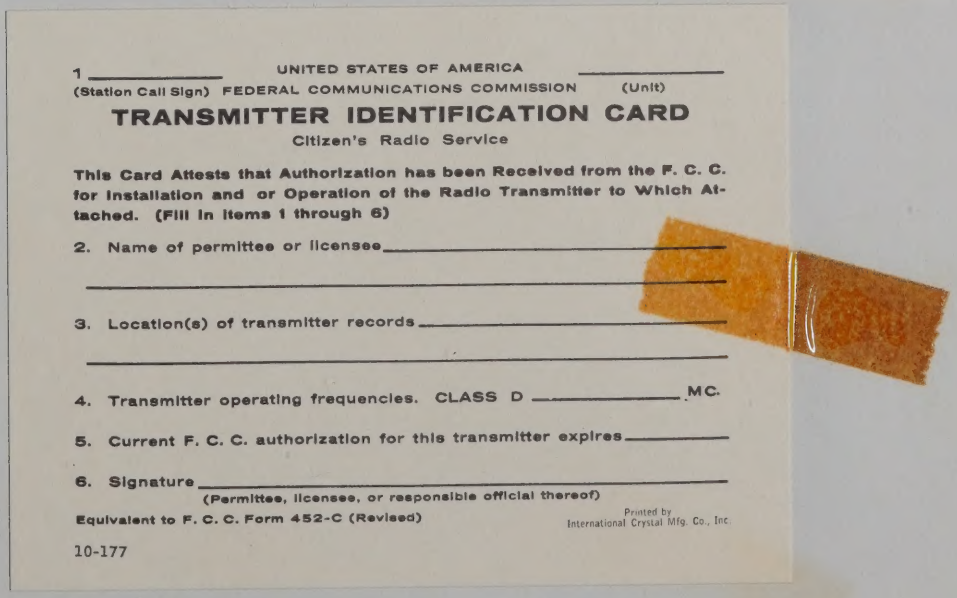
F.C.C. RULES & REGULATIONS

PART 19.72 POSTING OF STATION LICENSE

(b) The current authorization of each citizens radio station operated as a mobile station or operated at temporary locations may be retained in the permanent records of the station and need not be posted; However, an executed Transmitter Identification Card (FCC Form 452-C, Revised) shall be affixed to each transmitter which is operated as a mobile station or is operated at temporary locations, and to the control equipment of each such transmitter in every case where such transmitter is not in view from the location from which the station in controlled.

(c) The following information shall be entered on each Transmitter Identification Card (FCC Form 452-C, Revised) which is used for transmitter or station identification in accordance with the foregoing:

(1) Name of the station licensee;
(2) Station call sign assigned by the Commission (see 19.62);
(3) Exact location or locations of the permanent station records;
(4) Frequency or frequencies upon which the assoicated transmitter is adjusted to operate; and
(5) Signature of the licensee.



1 _____ UNITED STATES OF AMERICA _____
(Station Call Sign) FEDERAL COMMUNICATIONS COMMISSION (Unit)

TRANSMITTER IDENTIFICATION CARD

Citizen's Radio Service

This Card Attests that Authorization has been Received from the F. C. C. for Installation and or Operation of the Radio Transmitter to Which Attached. (Fill in items 1 through 6)

2. Name of permittee or licensee _____

_____

3. Location(s) of transmitter records _____

_____

4. Transmitter operating frequencies. CLASS D _____ MC.

5. Current F. C. C. authorization for this transmitter expires _____

6. Signature _____
(Permittee, licensee, or responsible official thereof)

Equivalent to F. C. C. Form 452-C (Revised)

Printed by International Crystal Mfg. Co., Inc.

10-177

CAUTION!

Although this unit is equipped with a special connector it is still possible for you to plug the power connecting cable improperly onto this equipment. Serious damage to the unit will occur if this happens. Double check the plug visually before turning the set on.

When this unit is being used in a vehicle the POWER SWITCH should be in the OFF position *before* starting the vehicle's engine. This practice will greatly extend the vibrator life.